INSTRUCTION MANUAL

MODEL 600
SIGNAL SWITCHING SYSTEM

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INSTRUCTION MANUAL

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MODEL 600
SIGNAL SWITCHING SYSTEM

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WAVETEK®

WAVETEK SAN DIEGO, INC.
9045 Balboa Ave., San Diego, CA 92123
P. O. Box 85265, San Diego, CA 92138
Tel 619/279-2200 TWX 910/335-2007

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SAFETY

This equipment contains a BR-½A, 3V lithium battery, that contains less than 0.3 grams of lithium. To prevent the battery from releasing a potentially harmful substance, do not recharge, short circuit, disassemble, or apply heat to the battery. In addition, observe correct polarity when replacing the battery.

This instrument is wired for earth grounding via the facility power wiring. Do not bypass earth grounding with two wire extension cords, plug adapters, etc.

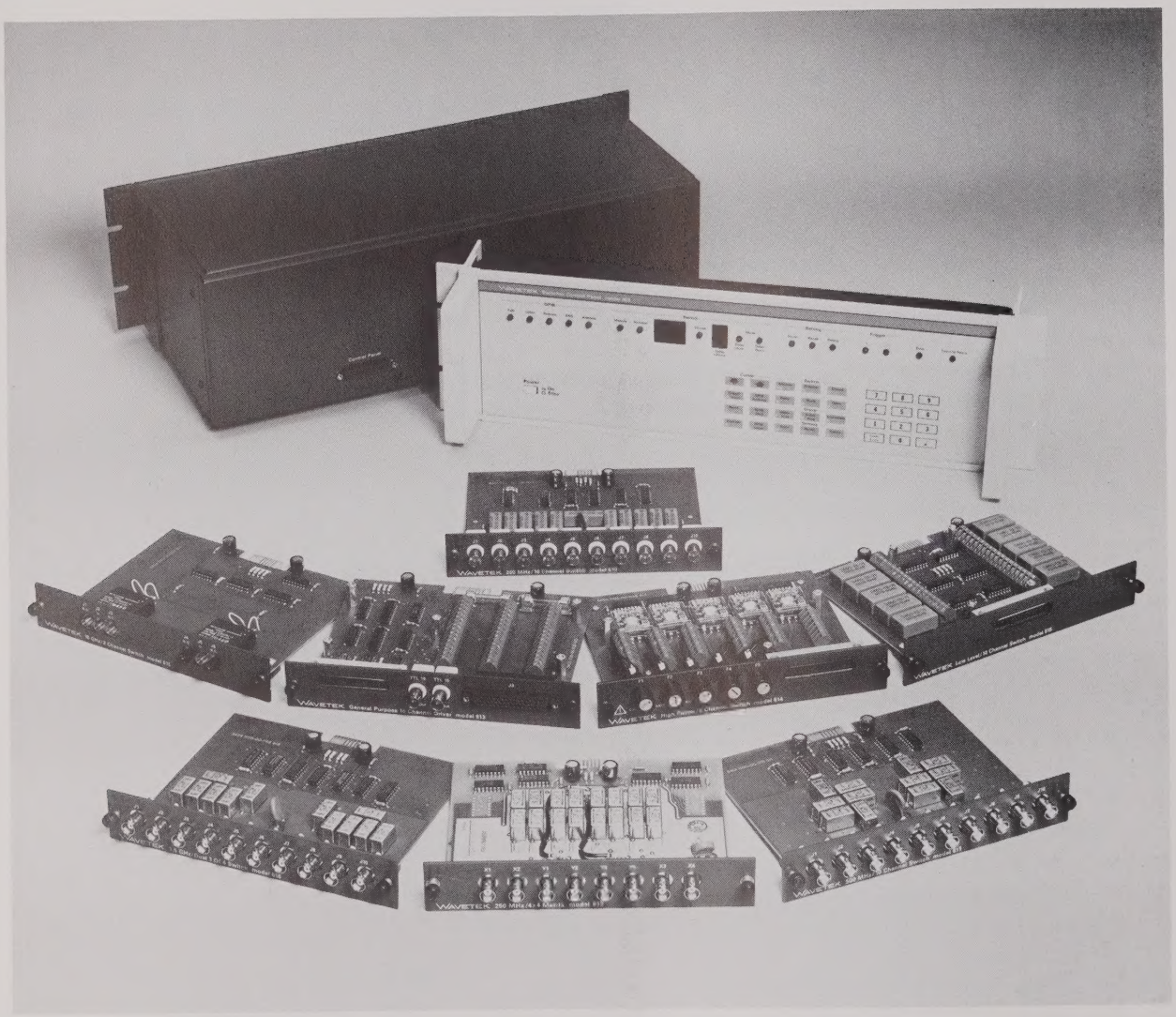
BEFORE PLUGGING IN the instrument, comply with installation instructions.

MAINTENANCE may require power on with the instrument covers removed. This should be done only by qualified personnel aware of the electrical hazards.

The instrument power receptacle is connected to the instrument safety earth terminal with a green/yellow wire. Do not alter this connection. (Reference: ⏚ or ⚠ stamped inside the rear panel near the safety earth terminal.)

WARNING notes call attention to possible injury or death hazards in subsequent operations.

CAUTION notes call attention to possible equipment damage in subsequent operations.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SECTION 1
GENERAL DESCRIPTION

1.1 DESCRIPTION

1.1.1 Model 600 Series

The Model 600 series, a small high performance programmable Signal Switching System, consists of the Model 601 Chassis, Model 602 Expansion Chassis, Model 603 Control Panel, and several switching modules. The 601 combined with up to 3 switching modules (up to 7 with the 602 Expansion Chassis) will cover a variety of signal switching applications.

The 600 series can be configured for a variety of installation requirements. For example: the 601 main chassis, by itself, can be mounted at the rear of a rack. This saves front rack space. If local manual control is desired, the 603 control panel can be mounted at the front of the rack and connected via a cable to the main chassis. The cable allows the chassis to be mounted at one level and the control panel at another level, as the rack configuration demands. For bench operation, nest the control panel into the main chassis.

Switch modules (up to 7) may be programmed remotely via the GPIB or locally by the optional Control Panel (603). Once programmed, up to 10 nonvolatile stored settings (50 optional) can be used to store and recall the configuration of every switch in a system. Recall of stored settings may be accomplished via control panel, GPIB, or Trigger Input (TTL signal).

Separate plug-in switching modules cover frequency ranges from dc to microwave frequencies with a variety of switching configurations, as well as power switching, low level switching, and general purpose driver.

Each individual switch of a module can be programmed to close or open with programmable time delays, thus allowing several levels of make-before-break or break-before-make operation.

1.1.2 Model 601

The Model 601 is the main chassis for the 600 series. It contains the GPIB interface, microprocessor control, power supplies, trigger BNCs, connectors for the 603 control panel, 602 expansion chassis, and space for three switching modules.

1.1.3 Model 602

The Model 602, the expansion chassis, contains space for four additional switching modules. Switch module control and power is supplied, via an interconnecting cable, from the main chassis (Model 601).

1.1.4 Model 603

The Model 603 control panel provides manual control and status display of switch modules and stored settings. The control panel can be mounted directly to the 601 main chassis or remotely operates the 601 via an interconnecting cable.

1.2 SPECIFICATIONS

1.2.1 Model 601 Chassis

1.2.1.1 Stored Settings

The 601 contains 10 stored settings (standard) with an additional 40 (Option 001). A stored setting retains the complete status of every switch of every module in the system (including the modules in the 602 expansion chassis). Settings can be stored, recalled, or deleted via the GPIB or 603 control panel. Also, the stored setting can be sequentially incremented via the external trigger input.

All stored settings are nonvolatile (backed up by battery) and memory retention is guaranteed for 6 months (5 years typical).

1.2.1.2 GPIB Programming

IEEE 488-1978 compatible, nonisolated, double buffered.

Address: 0 to 30; externally switch selectable.

Subsets: SH1, AH1, T6, TE0, L4, SR1, RL1, PP0, DC1, C0, E2.

Interface timing: All parameters less than 25ms.

1.2.1.3 Switch Module Slots

Three slots, numbered 1 through 3.

1.2.1.4 External Trigger Input

Switch closure or TTL level change causes one increment of stored setting. Greater than 50kΩ input impedance. Slope is programmable.

1.2.1.5 Trigger Output

A 1ms pulse occurs at the completion of an Execute command (after the longest switch delay). 500Ω source impedance.

1.2.1.6 Mounting

Model 601 can mount at front or rear of a standard 19 inch rack or be placed on a shelf or bench. Optional control panel can be remote or attached.

1.2.1.7 Environmental

Temperature Range: 0 to 50°C.
Warm-up Time: 0 Hours.
Altitude: Up to 10,000 ft. for operation, 40,000 ft. for storage.
Relative Humidity: 90% noncondensing.

Dimensions
Width: 43.2 cm (17 in.).
Height: 13.3 cm (5 1/4 in.).
Depth: 20.3 cm (8 in.).

Weight
5.2 kg (11½ lbs.) net; 6.8 kg (15 lbs.) shipping.

Power
90 to 108, 108 to 130, 198 to 238, or 216 to 259 Vac; 48 to 66 Hz; 1 phase; less than 60 watts. The chassis also supplies all power for the switching modules, control panel, and expansion chassis.

1.2.1.8 Option

Option 001
40 additional stored settings (total of 50) for Model 601.

1.2.2 Model 602 Expansion Chassis

1.2.2.1 Programming

All commands that control the switching modules in the expansion chassis are supplied via an interconnecting cable from the 601 main chassis.

1.2.2.2 Switch Module Slots

Four slots: numbered 4 through 7.

1.2.2.3 Mounting

Same as Model 601 main chassis.

1.2.2.4 Environmental

Temperature Range: 0 to 50°C
Warm-up Time: 0 Hours.
Altitude: Up to 10,000 ft. for operation, up to 40,000 ft. for storage.
Relative Humidity: 90% noncondensing.

Dimensions
Width: 43.2 cm (17 in.).
Height: 13.3 cm (5 1/4 in.).
Depth: 20.3 cm (8 in.).

Weight
3.8 kg (8½ lbs.) net; 5.9 kg (13 lbs.) shipping.

Power
Supplied by the Model 601 chassis.

1.2.3 Model 603 Control Panel

1.2.3.1 Mounting

The control panel may be rack mounted (mounting ears supplied) or mated with the 601 main chassis.

1.2.3.2 Environmental

Temperature Range: 0 to 50°C
Warm-up Time: 0 Hours
Altitude: Up to 10,000 for operation, 40,000 for storage.
Relative Humidity: 90% noncondensing.

Dimensions
Width: 43.8 cm (17 1/4 in.).
Height: 13.3 cm (5 1/4 in.).
Depth: 4.4 cm (1 3/4 in.) excluding handles.

Weight
1.6 kg (3½ lbs.) net; 3.2 kg (7lbs.) shipping.

Power
Supplied by the Model 601 main chassis.

SECTION 2
INSTALLATION AND INTERFACE

2.1 MECHANICAL INSTALLATION

After unpacking the instrument, visually inspect all external parts for possible damage to connectors, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the unit. The shipping container and packing material should be saved in case reshipment is required.

The switcher can be used as a bench unit or rack mounted. Figure 2-1 shows examples of switcher mounting configurations. It can be converted to rack mounts in the field.

2.1.1 601 Rack Mount

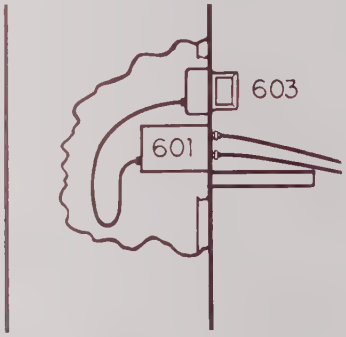
The 601 chassis comes with rack mounting ears on the rear panel. This allows rack mounting with the switching modules at the rear of the rack. Or, the rack mounting ears can be mounted to the front panel.

2.1.2 602 Rack Mount

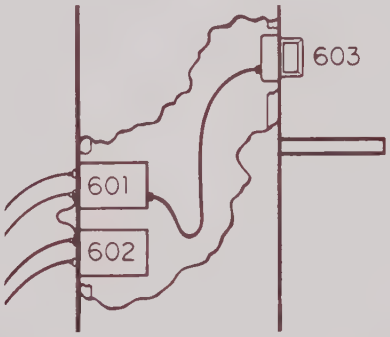
Rack mounting the 602 extension chassis is identical to the 601 chassis.

2.1.3 603 Rack Mount

The 603 control panel comes with rack mounting

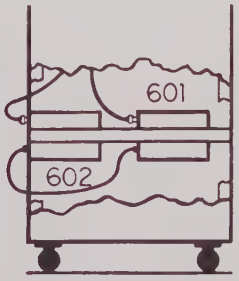


RACK MOUNT. FRONT PANEL MANUAL CONTROL AND I/O CONNECTIONS.



RACK MOUNT. FRONT PANEL MANUAL CONTROL AND REAR PANEL I/O CONNECTION.

BENCH TOP MOUNTING. CONTROL PANEL MATED WITH CHASSIS.



RACK MOUNT. GPIB CONTROL WITH SLIDE MOUNTED CHASSIS (ADAPTERS REQUIRED).

Figure 2-1. Switcher Mounting Examples

ears. Or, the rack ears can be removed and the control panel attached to the 601 chassis.

2.1.4 Attaching the 603 Control Panel to the 601 Chassis

To install the control panel into the chassis follow these steps.

1. Remove the mounting ears and spacers from the control panel.
2. Remove the front panel from the 601 chassis.
3. Remove the connector from the front panel of the 601 chassis.
4. Plug in the connector at the rear of the control panel.
5. Slide the control panel into the chassis and secure. For rack mounting install the rack mounting ears.

2.2 ELECTRICAL INSTALLATION

2.2.1 Power Connection

Before rack mounting, it may be desirable to perform an initial checkout to verify operation of all functions.

NOTE

Unless otherwise specified at the time of purchase, this instrument was shipped from the factory with the power transformer connected for operation on a 120 Vac line supply and with a 3/4 amp fuse.

Conversion to other input voltages requires a change in rear panel fuse holder voltage card position and fuse (figure 2-2) according to the following procedure.

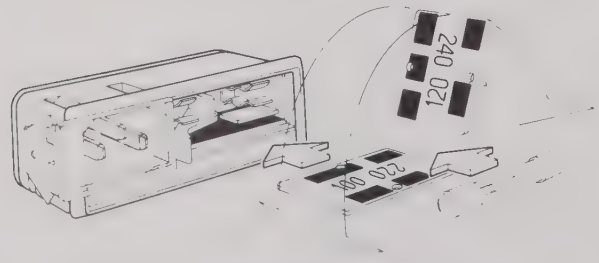


Figure 2-2. Voltage Selector and Fuse

1. Disconnect the power cord at the instrument, open fuse holder cover door and rotate fuse-pull to left to remove the fuse.
2. Remove the small printed circuit board and select operating voltage by orienting the printed circuit board to position the desired voltage to the top left side. Push the board firmly into its module slot.

Card Position	Input Vac	Fuse
100	90 to 108	3/4 amp
120	108 to 130	3/4 amp
220	198 to 238	3/8 amp
240	216 to 259	3/8 amp

3. Rotate the fuse-pull back into the normal position and insert the correct fuse into the fuse holder. Close the cover door.
4. Connect the ac line cord to the mating connector at the rear of the unit and the power source.

2.2.2 Signal Connections

NOTE

Use coaxial cables equipped with BNC connectors to distribute signals.

601 chassis BNC connectors are:

Trigger Input — A TTL level input or contact closure to ground increments the next stored setting and provides an execute. Trigger slope is programmable. Input impedance is $\geq 50k\Omega$.

Trigger Output — A 1ms TTL level pulse which is generated at completion of an execute. Source impedance is 500Ω.

There are signal connectors on the switching modules which are described in Appendix A.

2.2.3 Control Cable Connections

Expansion Chassis: Connects via a cable to the rear panel of the 601 chassis.

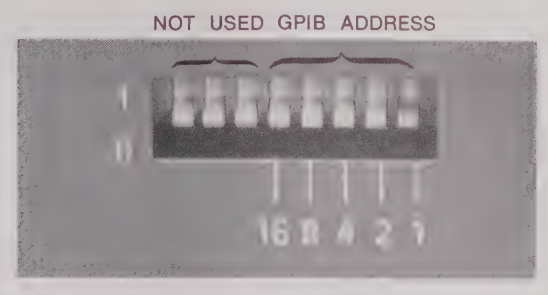
Control Panel: Connects via a cable to the front panel of the 601 chassis.

2.2.4 GPIB Connector

The GPIB I/O rear panel pin connections and signal names are given in table 2-1. The panel connector is an Amphenol 57-10240 or equivalent. GPIB interconnecting cable are available from Wavetek in 1 and 2 meter lengths.

2.2.5 GPIB Address

For instruments on the General Purpose Interface Bus



NOTE: GPIB ADDRESS SELECTED IS DECIMAL 0: SWITCH 1 – OFF, 2 – OFF, 3 – OFF, 4 – OFF, 5 – OFF. (TABLE 2-2 0000).

Figure 2-2. GPIB Address Selector Switch

Table 2-2. GPIB Address Codes

Device	ASCII Listen	ASCII Talk	Switch Position 16 8 4 2 1	Hexa-decimal Listen	Hexa-decimal Talk
0	(space)	@	0 0 0 0 0	20	40
1	!	A	0 0 0 0 1	21	41
2	"	B	0 0 0 1 0	22	42
3	#	C	0 0 0 1 1	23	43
4	$	D	0 0 1 0 0	24	44
5	%	E	0 0 1 0 1	25	45
6	&	F	0 0 1 1 0	26	46
7	'	G	0 0 1 1 1	27	47
8	(	H	0 1 0 0 0	28	48
9	)	I	0 1 0 0 1	29	49
10	*	J	0 1 0 1 0	2A	4A
11	+	K	0 1 0 1 1	2B	4B
12	,	L	0 1 1 0 0	2C	4C
13	—	M	0 1 1 0 1	2D	4D
14	•	N	0 1 1 1 0	2E	4E
15	/	O	0 1 1 1 1	2F	4F
16	0	P	1 0 0 0 0	30	50
17	1	Q	1 0 0 0 1	31	51
18	2	R	1 0 0 1 0	32	52
19	3	S	1 0 0 1 1	33	53
20	4	T	1 0 1 0 0	34	54
21	5	U	1 0 1 0 1	35	55
22	6	V	1 0 1 1 0	36	56
23	7	W	1 0 1 1 1	37	57
24	8	X	1 1 0 0 0	38	58
25	9	Y	1 1 0 0 1	39	59
26	:	Z	1 1 0 1 0	3A	5A
27	;	[	1 1 0 1 1	3B	5B
28	<	\	1 1 1 0 0	3C	5C
29	=	]	1 1 1 0 1	3D	5D
30	>	↑	1 1 1 1 0	3E	5E

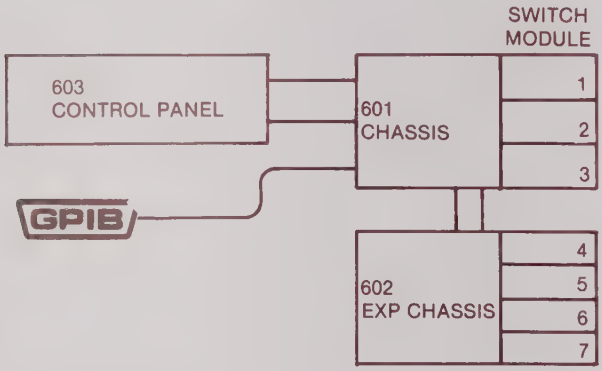
NOTE

Address 31 is not allowed.

3.1 SIMPLIFIED OPERATING INSTRUCTIONS

The following steps provide simplified operating instructions, emphasizing hands-on experience, with a minimum of command details. For greater command details, refer to paragraph 3.2.

The setup, shown below, assumes the system consists of the 601 chassis, the 603 control panel, and at least one switching module.



1. POWER ON

To power up the 601, press ON/OFF located on the 601s rear panel and press Power On/Stby on the control panel.

Notice the control panel always powers up to the lowest numbered slot. For example, if slot 1 is filled, the control panel status will be:

The 601 chassis wakes up in the following conditions:

Module	Number of the lowest numbered module slot.
Number	1
Delay (All)	0
Trigger Input	Off
Mode (All)	0 — No Delay
All Switches	Open

These are also the RESET conditions.

2. TONE KEY

An audible tone will sound when a key is pressed. Pressing ♪ will inhibit the tone. If there is no tone when the keys are pressed, pressing ♪ restores the tone.

3. MODULE

To select a module, press [Module XM] followed by a numeric entry. Only the slots with modules installed will accept a module number program. All other will give an error indication when the number is terminated.

To identify which slots have modules in them press [Module XM] followed by [▲] or [▼]. Note which slots have modules in them.

As an example, press [Module XM] [1]. Module 1 is now selected. Control panel status:

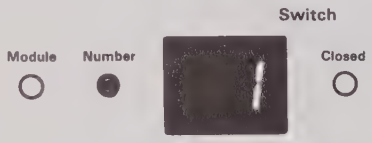
4. NUMBER

To select a switch within the module, press [Number K]

followed by a numeric entry. Each type of module has a different number of switches.

To identify the number of switches in the module, press [Number K] followed by [▲] or [▼]. Note the number of switches in the module.

As an example, press [Module XM] [1]. Control panel status:



Switch 1 of module 1 is now selected.

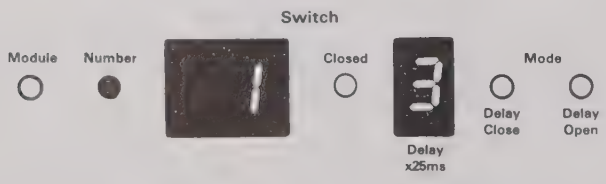
5. DELAY

To select a delay time slot, press [Delay D] followed by a time slot code. Or, the codes may be sequentually stepped through using the cursor.

Code	Time Slot
0	0 ms
1	25 ms
2	50 ms
3	75 ms
4	100 ms
5	125 ms
6	150 ms
7	175 ms

As an example, press [Delay D] [3] [Delay D].

Control panel status:



This selects a 75 ms delay after receiving an execute.

6. MODE

To select the switch delay mode, press [Mode B].

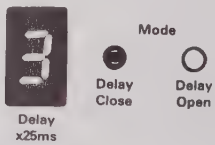
Each time the Mode key is pressed the 601 steps in order to the next mode. At the last step the mode cycles back to the first mode.

Delay	Indicator	
No Delay	0	0
Delay Close	●	0
Delay Open	0	●
Delay Both	●	●

The 618 module does not recognize the Delay Open and Delay Both commands.

As an example, select Delay close.

Control panel status:



7. CLOSED/OPEN SWITCH

The [Closed C] and [Open O] keys selects the configuration of the switch after receiving an Execute command.

To set the switch program to closed, press [Closed C].

NOTE

The Execute Req'd lamp lights; this indicates the closed program has not been transferred to the switch module.

Control panel status:

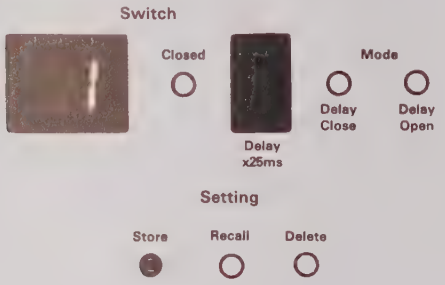
To set the switch program to open, press [Open O].

Control panel status:

8. STORE

To store a complete set of switch parameters, press [Store M] followed by the location 1 to 10 (1 to 50 option 001) and any parameter key.

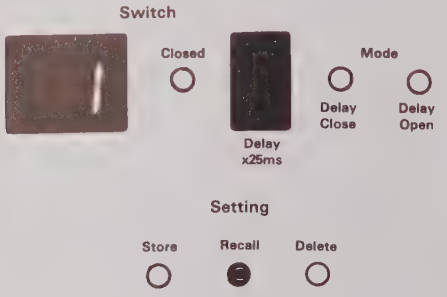
As an example, press [Store M] [1] [Store M] (or any parameter key). Control panel status:



9. RECALL

To recall a complete set of switch parameters, press [Recall Y] followed by the location and any parameter key.

As an example press, [Recall Y] [1] [Recall Y]. Control panel status:

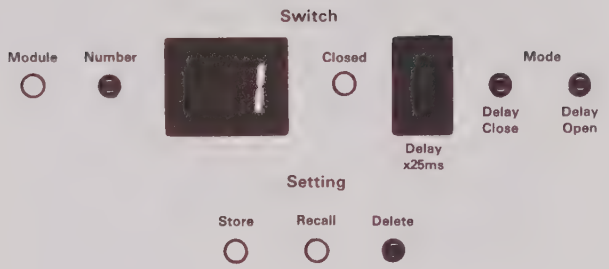


10. Delete

To delete a complete set of parameters, press [Delete L] followed by the location and any parameter key.

As an example, press [Delete L] [1] [Delete L] .

Control panel status:

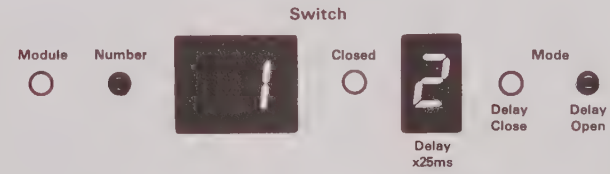


Now, press Recall followed by [▲] or [▼] and observe that the 601 skips setting number 1.

11. MAKE FIRST

Press [Make F First] to set all switches in the module to make-before-break action. This command is not allowed for the 618 module.

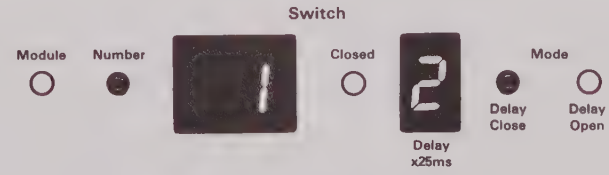
Control panel status:



12. BREAK FIRST

Press [Break G First] to set all switches in a module for break-before-make action.

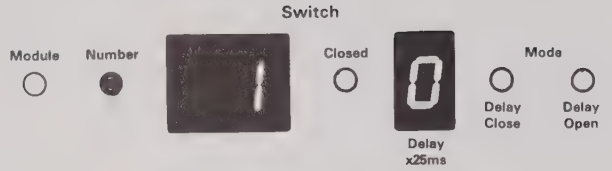
Control panel status:



13. IMMEDIATE

Press [Immediate H] to set all switches in a module for immediate action.

Control panel status:

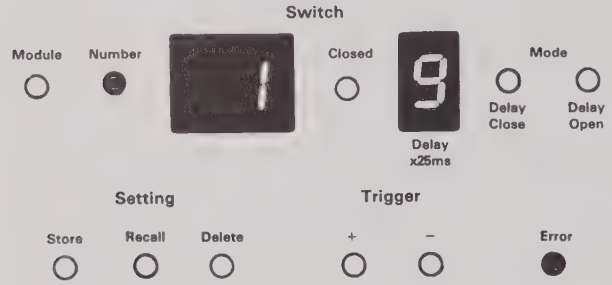


14. ERRORS

Flashing indicators and a low frequency tone indicate a control panel data entry error. Press any parameter key, except execute, to stop the flashing.

As an example press [Delay D] [9] [Delay D].

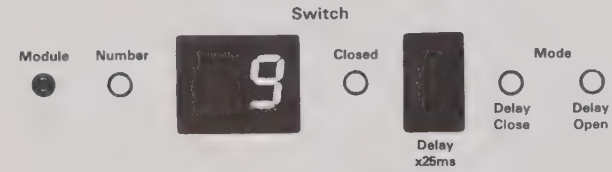
Control panel status:



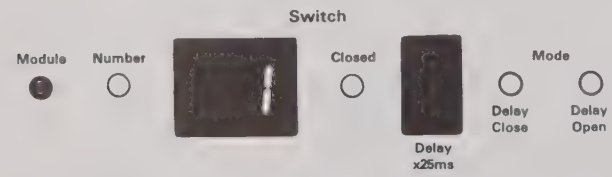
15. CLEAR ENTRY

To clear an unexecuted entry, press [Clear Entry].

As an example, press [Module XM] [9]. Control panel status:



Then press [Clear Entry]. Control panel status:



16. GPIB ADDRESS

To examine the GPIB address press [GPIB Address]. Control panel status:

Note: The GPIB address can be any number between 0 and 30. (Address 31 can be selected, but should be considered an illegal address.)

17. GPIB SRQ

To initiate a GPIB service request from the control panel, providing the correct SRQ mode is selected, press [GPIB SRQ]. The control panel beeps and supplies a low frequency tone when the SRQ Mode is not programmed for a control panel SRQ or the 601 is in remote.

18. RESET

Press [Reset Z] to return the 601 to the power-up conditions. The execute Req'd lamp, if lit, will extinguish.

19. EXECUTE

Press [Execute I] to transfer all parameters to the switch modules. The Execute Req'd lamp, if lit, will extinguish.

3.2 INTRODUCTION

The Model 600 series is a signal switching system of which the Model 601 Chassis is the basic unit. The 601 contains the GPIB interface, power supplies and switching module slots (refer to figure 3-1).

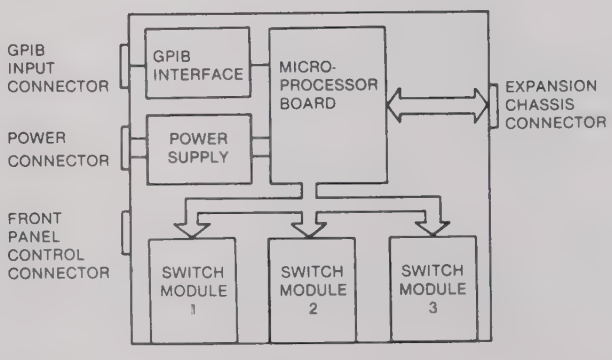


Figure 3-1. Model 601 Switcher

Each system should be thought of as a custom system. That is, module selection, programming, and signal flow will depend upon system requirements. Evaluate these requirements before programming. Figure 3-2 shows an example of a simple switching system. Once the system requirements are understood the programming can begin.

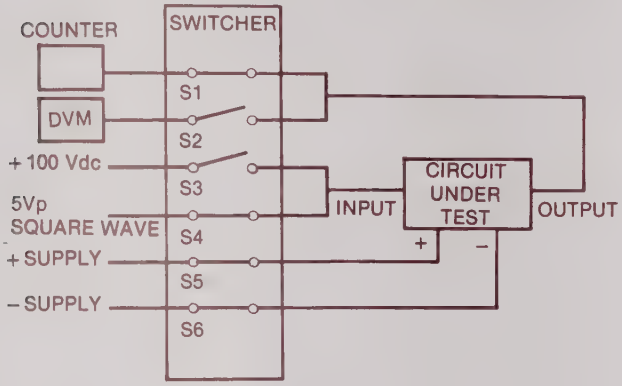


Figure 3-2. Switcher Example

Programming involves selecting a module, a switch within the module, opening or closing the switches, and specifying switch actuation mode and delay. Selection of actuation mode and delay allows control of switch timing either individually or as groups.

Individual switches can be programmed to actuate with 8 different delay settings (0 to 175ms in 25ms increments). The delay is measured from the receipt of an Execute command to the switch actuation. Each individual switch also can be programmed to operate in one of four actuation modes that modifies the delay specifications.

Delay open	The delay only occurs when the switch is opening. The switch closes immediately.
Delay close	Opposite of delay open.
Both	Delay occurs when opening and closing.
Neither	Delay is ignored and switch is actuated immediately.

In addition, the entire group of switches within a selected module can be programmed to operate in make-before-break, break-before-make, or immediate modes. When these group commands are used, the 601 automatically determines the correct actuation mode and delay, and, after an Execute command, programs the module.

3.3 PROGRAMMING

3.3.1 Introduction

This section describes the programming of the 601 Chassis. Data may be programmed into the 601 chassis by a GPIB controller or the Model 603 control panel. For a sample program using a GPIB controller, refer to Appendix D in the rear of this manual. Information related to the programming is presented in the following order:

1. General programming information.
2. Commands common to the GPIB and Control Panel.
3. GPIB only commands.
4. Control Panel only keys.
5. Control Panel indicators.
6. 601 Chassis signal connectors.

All control panel keys and indicators are keyed to figure 3-3.

3.3.2 Data Entry

The Model 601 is programmed by sending ASCII coded characters (ref: table 3-1 and Appendix B) to the microprocessor via one of the two possible input ports (GPIB or control panel). If input characters are present on more than one input port, they are read first from the GPIB and then from the Control Panel. Thus, if the GPIB port is continuously supplied with characters, then no characters will ever be read from the Control Panel and the Control Panel will appear inactive to the user.

3.3.2.1 Characters

Character used to program the 601 are divided into classes:

1. Alphabetic Characters—The upper and lower case characters A through Z (except X, x, E, and e) select actions or commands.
2. Numeric Characters—The characters 0 through 9, E, e, –, and decimal point (.).
3. Terminator Character—Initially the ASCII new line character (NL). This can be changed by programming.
4. Nonprogramming Characters—Any character not in one of the previously described classes. They have no effect on programming and may be interspersed freely among programming characters.
5. Extender Character—Upper or lower case X, x. Used to extend the alphabetic characters as parameter headers.

Location In Figure	Function	Reference Paragraph
1	GPIB Indicators	3.3.12.2
2	Switch Indicators	3.3.12.3
3	Two digit display	3.3.12.4
4	Setting Indicators	3.3.12.5
5	Trigger Indicators	3.3.12.6
6	Error Indicators	3.3.12.7
7	Execute Req'd Indicator	3.3.12.8
8	Numeric, Tone, Clear Entry Keys	3.3.2.3
9	Switch Keys	3.3.7
10	Group Keys	3.3.8
11	Setting Keys	3.3.9
12	GPIB Keys	3.3.12.1
13	Miscellaneous Keys	3.3.10
14	Cursor Keys	3.3.5
15	Power Switch	3.3.6

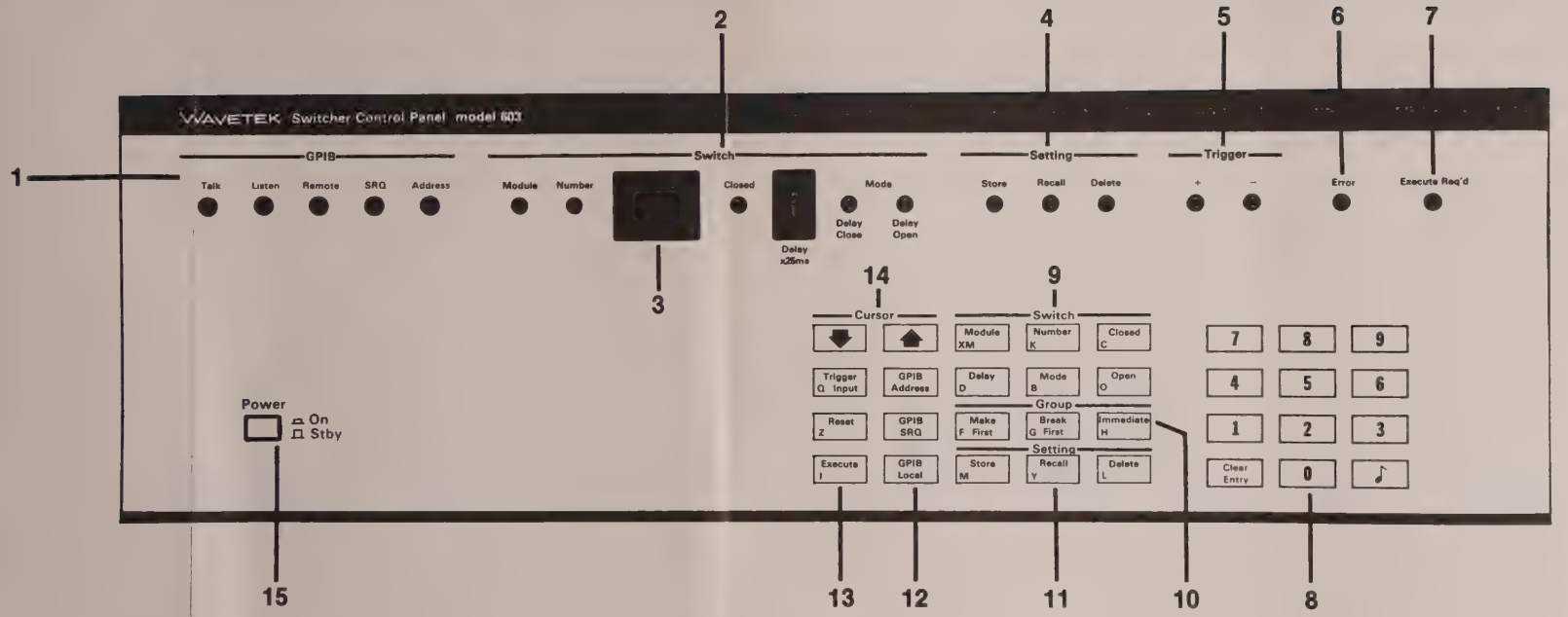


Figure 3-3. Control Panel Keys and Indicators

Table 3-1. Model 601 GPIB Programming Codes

Command	Code	Action (A) or Parameter (P)
Mode	B	P
Closed	C	P
Delay	D	P
Make First	F	P
Break First	G	P
Immediate	H	P
Execute	I	A
Number	K	P
Delete	L	P
Store	M	P
Open	O	P
Trigger Input	Q	P
Recall	Y	P
Reset	Z	A
GET Mode	XG	P
Module	XM	P
SRQ Mode	XQ	P
Talk Mode	XT	P
Decrement Recall	XU	A
Terminator Type	XV	P
Increment Recall	XW	P

3.3.2.2 Action Vs Parameters

There are two type of commands used in the 600 series: parameters and actions (ref: table 3-1). There are two types of parameters: those that require a numeric value or code, and those that do not require a value or code; both require an execute. Actions take place immediately; they do not require a value, code, or execute.

3.3.2.3 Numeric Values

The digits 0 through 9 make up the numeric values. Legal values or codes depend upon the parameters selected. Unexecuted values can be erased by the Clear Entry key (control panel).

3.3.3 Errors

When an illegal value is programmed, an error signal is indicated on the the GPIB or Control Panel. For errors made via the GPIB (but not the control panel), the Service Request line (SRQ) is asserted, providing a Service Request mode (XQ) has been selected (ref: paragraph 3.3.11.5). The controller can then serial poll its instruments to verify that the 601 sent the SRQ and can then inquire as to the nature of the 601 error. The method of reporting errors on the GPIB is given in paragraph 3.3.11.4. Control panel errors are indicated on the control panel by flashing lamps and a low frequency tone.

3.3.3.1 Class 1 Errors

Class 1 errors are caused by programming values outside the legal limits of the parameter. For example, programming switch number 99 will cause a parameter error when the next alpha character is programmed. The 601 disregards the new values and retains the previously programmed values in scratch pad memory.

3.3.3.2 Class 3 Errors

Class 3 errors occur if an empty stored setting is retrieved. The error is displayed and the state of the 601 remains unchanged from the previously executed program.

3.3.4 Executing The Program

A program or setting can be executed, i.e., transferred to the modules circuits by execute commands, GET (Group Execute Trigger) command, and Trigger Input.

GPIB **I** and the control panel Execute key are execute commands that transfer the programmed values to the switch modules.

GET is a GPIB command (no control panel key) that causes the 601 to execute and provides bus synchronization.

GPIB Z and control panel Reset are commands that reset the 601 to the original power up conditions (ref: paragraph 3.3.10.2).

A lit Execute Req'd lamp indicates that some switch open/closed programs have not been executed and resides in scratch pad memory only.

3.3.5 Cursor

The two cursor keys (**14**), located on the 603 Control Panel, can increment or decrement the following parameter values:

Module
Number
Delay
Store
Recall
Delete

When the cursor keys are used with Recall, they also cause an Execute. Cursor rate is 5 per second. Cursor

action automatically wraps-around when a parameters upper or lower limit is reached.

3.3.6 Power

The main power switch is located on the rear of the 601 chassis. The power switch on the 603 control panel only controls transformer secondary voltage switching and does not interrupt the 110/220 Vac input.

3.3.7 Switch Parameters

3.3.7.1 Module

XM, followed by its value 1 to 3 (601 chassis) or 1 to 7 (added 602 expansion chassis), selects a switch module slot.

On the control panel, the Module key (**9**) performs the same function. The module indicator (**2**) lights and the display (**3**) indicates the number of the module selected.

If an empty module slot is selected, the 601 will generate a class 1 error response.

3.3.7.2 Number

K, followed by a numeric value, selects the switch number within the selected module. The maximum numeric value depends upon the switch module (refer to Appendix A).

On the control panel, the Number key (**9**) performs the same function. The number indicator (**2**) lights and the display (**3**) indicates the number of the switch selected.

If a switch number is selected that does not exist the switcher generates a class 1 error.

3.3.7.3 Closed

C sets the selected switch program to closed. No numeric value is required with this parameter. This command must be followed by an execute to actuate the switch.

On the control panel, the Closed key (**9**) performs the same function. The closed indicator (**2**) lights.

3.3.7.4 Open

O sets the selected switch to open. No numeric value is required with this parameter. This command must be followed by and execute to actuate the switch.

On the control panel, the Open key (**9**) performs the same function. The Closed indicator (**2**) is out.

3.3.7.5 Mode

B, followed by a code (0 through 3), selects the delay mode of the selected switch:

B0 selects no delay.
B1 selects delay on close.
B2 selects delay on open.
B3 selects both delay on open and close.

The 618 module will not accept either the Delay Open (B2) or Delay Both (B3) commands.

The command Delay sets the time of the delay.

On the control panel, press the Mode key (**9**) steps to the next delay mode. The modes are stepped in the following order: no delay, delay close, delay open, and both. The Mode indicators (**2**) will be off for no delay, on for each delay close and delay open, or both on for both delayed.

3.3.7.6 Delay

D, followed by a code (0 through 7), selects the delay time slot of the selected switch. Each digit of the code represents a 25ms delay, as shown below.

Code	Time Slot
0	0ms
1	25ms
2	50ms
3	75ms
4	100ms
5	125ms
6	150ms
7	175ms

On the control panel, pressing the Delay key (**9**) performs the same function. The Delay display (**2**) indicates the time slot code.

3.3.8 Group Commands

3.3.8.1 Make First

F causes all switches on the selected module to be programmed for make-before-break operation. No numeric value is required for this parameter. The fixed-delay is 50ms. The 618 module will not accept a Make First command.

On the control panel, pressing the Make First key (**10**) performs the same function. The Delay display (**2**) indicates a 2 for a 50ms delay. The Delay Open indicator (**2**) is lit.

3.3.8.2 Break First

G causes all switches on the selected module to be programmed for break-before-make operation. No numeric value is required for this parameter. The fixed delay is 50ms.

On the control panel, pressing the Break First key (**10**) performs the same function. The Delay display (**2**) indicates a 2 for a 50ms delay. The Delay Closed indicator **(2)** is lit.

3.3.8.3 Immediate

H programs all switches on the selected module to immediate actuation. There is no programmed delay. No numeric value is required for this parameter.

On the control panel, pressing the Immediate key (**10**) performs the same function. The Delay display (**2**) indicates 0 for 0ms delay. Both Mode indicators (**2**) are out.

3.3.9 Stored Settings

Up to 10 different nonvolatile settings can be stored, recalled and deleted from Random Access Memory (RAM). Option 001 increases the number of stored setting to 50. Nonvolatile memory is battery backed for 6 months (min.) 5 years (typ.) retention of settings.

A stored setting consists of all switch program (open/close, delay, mode, etc) for every switch in the system, including the expansion chassis.

3.3.9.1 Store

M, followed by a numeric value (1 to 10 standard or 1 to 50 optional), stores the current instrument setup in memory. All module and switch information, except trigger configuration, is stored. A terminator is required.

On the control panel, pressing the Store key (**11**) performs the same function. The display (**3**) will indicate the setting location selected and the Store indicator (**4**) is lit.

3.3.9.2 Recall

Y, followed by a numeric value (0 to 10 standard or 0 to 50 optional), recalls all switcher setups from memory. All module and switch information, except trigger configuration, is recalled. An execute (I) is required.

On the control panel, pressing the Recall key (**11**) performs the same function. The display (**3**) will indicate the setting location recalled and the Recall indicator (**4**) is lit.

3.3.9.3 Delete

L, followed by a setting location (1 to 10 standard or 1 to 50 optional) and a terminator, deletes a switcher setup from memory. All module and switch information is deleted.

On the control panel, pressing the Delete key (**11**) performs the same function. The display (**3**) will indicate the setting location to be deleted and the Delete indicator (**4**) will be lit.

3.3.9.4 Stored Setting 0

Stored setting location 0, a special setting, automatically updates each time an execute is completed. Therefore, Recall 0 always restores the 601 to the setup after the last execute. Since stored settings are nonvolatile the last setup will be retained even after power off. Attempting to store into or delete location 0 will result in an error.

3.3.10 Miscellaneous Commands

3.3.10.1 Trigger Input

Q, followed by a code (0 through 2) and a terminator, selects the trigger input configuration.

- Q0 Selects OFF, the trigger input is ignored.
- Q1 Selects +, on the positive slope of the trigger input signal the 601 increments to the next stored setting.
- Q2 Selects −, on the negative slope of the trigger input signal the 601 increments to the next stored setting.

On the control panel, pressing the Trigger Input key (**13**) steps to the next trigger input configuration and instantaneously configure it. They are stepped in the following order: OFF, positive slope, or negative slope. The appropriate trigger indicator (**5**) will light. If both indicators are out the trigger input is off.

3.3.10.2 Reset

Z instantly resets the switcher to following conditions.

All switches open.
All switch modes to 0.
All delays to 0.
Trigger input to off.

On the control panel, pressing the Reset key (**13**) performs the same function.

3.3.10.3 Execute

I instantly transfers the entered switch information to the switch modules.

On the control panel, pressing the Execute (**13**) key performs the same function. The Execute Req'd indicator (**7**) will go out as the key is pressed.

3.3.11 GPIB

The GPIB interface is an implementation if IEEE Stan-

dard 488-1978. It supports the following interface functions: SH1-Complete source handshake, AH1-Complete acceptor handshake, T6-Basic talker, TE0-No extended talker, L4-Basic listener, SR1-Complete service request (software select), RL1-Remote/local and local lockout, PP0-No parallel poll capability, DC1-Complete device clear/selective device clear, DT1-Complete device trigger capability, E2-Tri-state drivers.

3.3.11.1 Bus Lines Defined

The GPIB consists of 16 negative true signal lines.

1. **DIO1 — DIO8** These eight lines (Data In/Out) are used to send commands from the controller and transfer data back and forth between instruments and the controller.
2. **ATN** This line (Attention) is operated only by the controller. It specifies whether the information on lines DIO1- DIO8 is data (ATN false) or a command (ATN true). Whenever ATN is true, no activity is allowed on the bus except for controller-originated messages; additionally, every device connected to the bus is required to receive and process every command sent by the controller.
3. **REN** This line (Remote Enable) controls whether devices on the GPIB are allowed to be in the remote mode. In local mode, devices respond to control panel commands and do not respond to GPIB originated commands. In remote mode, the situation is reversed: GPIB originated commands are obeyed, while control panel commands are ignored. The 601 enters the remote state when it receives its listen address (ref: paragraph 3.3.11.2) and REN is enabled. The 601 then stays in the remote mode until the REN line is put in the local state, a Go To Local (GTL) command is received or the GPIB Local control panel key is pressed (ref: paragraph 3.3.11.2.3, item 4).
4. **DAV, NRFD, NDAC** These are the "handshake" lines (Data Valid, Not Ready For Data and Not Data Accepted) which regulate the transmission of information over the lines DIO1- DIO8. For each command or data byte transferred, a complete hand shake cycle occurs.
5. **EOI** When ATN is false, EOI (End Or Identify) indicates that the data on lines DIO1- DIO8 is the last byte of a data message. When the 601 receives a data byte with EIO true, the 601 automatically supplies a terminator character (ref: paragraph 3.3.11.7) following the data byte. When the 601 transmits the last byte of a message (which is always a terminator character), it also sets EOI true.
6. **SRQ** This line (Service Request) is used by the 601 and other devices on the bus to signal the controller that they request attention. (Ref: paragraph 3.3 for 601 Service Request Enable.) Since the SRQ line is common to all devices, additional tests must be made to determine which devices are signaling. The controller performs a Serial Poll to accomplish this.
7. **IFC** This line (Interface Clear) is used by the controller to reset the interface logic in all devices connected to the bus to a known initial state.

3.3.11.2 Commands

Commands are sent over lines DIO1- DIO8 with ATN true. They are divided into five classes.

1. Listen Addresses
2. Talk Addresses
3. Secondary Addresses
4. Universal Commands:

   DCL – Device Clear
   SPE – Serial Poll Enable
   SPD – Serial Poll Disable
   LLO – Local Lockout

5. Addressed Commands:

   GTL – Go To Local
   SDC – Selective Device Clear
   GET – Group Execute Trigger

These commands and command groups are shown with their binary codes in Appendix B and further explanation follows.

3.3.11.2.1 Listen Addresses

Listen addresses are used to command a device to read any data bytes transmitted over lines DIO1-DIO8. There are 31 different available addresses (hexadecimal codes 20 through 3E, ASCII codes SP through >). A 32nd address, called unlisten (hexadecimal 3F, ASCII ?) is used to command all devices to not read data bytes. The 601 listen address is selected by the GPIB switch located on the rear panel of the 601 chassis. Pressing the control panel Address key displays the GPIB address as a decimal device number.

3.3.11.2.2 Talk Address

Talk addresses are used to command a device to transmit data over lines DIO1-DIO8 whenever ATN is false. There are 31 different available addresses (hexadecimal codes 40 through 5E, ASCII codes @ through Λ). The lower 5 bit of the 601 talk address are selected by the same rear panel switches used to

select the listen address. Thus, if the 601 listen address is hexadecimal 21 (ASCII !), the talk address is hexadecimal 41 (ASCII A). Pressing the control panel GPIB Address key displays the GPIB address as a decimal device number.

3.3.11.2.3 Universal Commands

Universal commands are used to command a device to perform designated actions. Universal commands are recognized at all times. Universal commands performed by the 601 are:

1. **Device Clear (DCL)** Resets the 601 to the initial power on settings. DCL Affects all devices on the bus.
2. **Serial Poll Enable (SPE)** Causes the instrument to engage in a serial poll by responding with the serial pull status byte when addressed as a talker. Data line DIO7 will be on, if service is being requested on the SRQ line.
3. **Serial Poll Disable (SPD)** Discontinues serial poll. Returns instruments to normal talk modes.
4. **Local Lockout (LLO)** Causes the GPIB interface to enter a state where the control panel the Local key is inoperative. Once in this state, the only way to take the interface out of it is to put the REN line in the local state (ref: paragraph 3.3.11.1 item 3). Local lockout must be sent to the 601 to totally disable control panel modification of the state of the instrument.

3.3.11.2.4 Addressed Commands

Addressed commands are used to command a device to perform designated actions. Addressed commands are recognized only when the instrument is addressed as a listener. Addressed commands performed by the 601 are:

1. **Go To Local (GTL)** Commands the 601 to go to the local mode (ref: paragraph 3.3.11.1, REN).
2. **Selective Device Clear (SDC)** Resets the 601 to initial power on conditions.
3. **Group Execute Trigger (GET)** Causes the actions specified by the GET mode (XG) code (ref: paragraph 3.3.11.5).

3.3.11.3 Data Transfer

In addition to accepting programming characters, the 601 will transmit status information over the bus. To program the instrument, first send the listen address (with ATN on), followed by the programming data (in ASCII, with ATN off). The instrument microprocessor accepts the data as fast as possible, until either 64 characters are received of there is a pause during the transfer of data. At that time, the entire string of received characters is scanned by the microprocessor, which carries out the scan and accepts the next 64 character string. Whenever the microprocessor is finished scanning a string, it puts a display on the control panel which reflects the state of input processing at that point. If the EOI line is asserted while sending a character to the 601, the currently programmed terminator character will be put into the input string following the character with the EOI.

3.3.11.4 Talk Mode

XT, followed by a code (0 through 4), specifies how the 601 chassis responds when addressed as a talker.

XT0 Selects the program error list. A typical program error list is E 1K 3Y where:

a. All error lists begin with E followed by a space.

b. The most recent error appears at the end of the list.

c. Errors are separated by spaces.

d. An error consists of a number identifying the error class and a header identifying the parameter that caused the error.

Reading the error list will clear it.

XT1 Selects the poll byte response. A typical response might be P A where:

a. All responses begin with P followed by a space.

b. The third character has the same value as the serial poll response byte. This character has a decimal value between 0 and 255. In the typical response above the A represents a decimal value of 65. See paragraph 3.3.11.5.

Reading the poll byte clears it.

XT2 Selects the switch status talk response. In this mode all parameters describing a switch configuration will be returned. A typical response might be K9CD3B1 where:

a. K9 is the switch number.

b. C indicates the switch is closed. An O represents an open switch.

c. D3 indicates a delay of 3 (75ms).

d. B1 indicates delay mode 1 (Delay Closed).

XT3 Selects the module model number as the talk response. In this mode the 601 returns the model number of the currently selected switch module. A typical example might be 611.

XT4 Selects the version identification: 601 (V1.7), where (V1.7) identifies the software version.

3.3.11.5 SRQ Mode

XQ followed by value (0 through 255) selects the conditions under which the 601 asserts the SRQ line and rsv bit. The equivalent binary value is a "mask" for the serial poll response byte (ref: table 3-2). The binary mask selects certain conditions that will be recognized as conditions that asserts the SRQ line and rsv bit. All other conditions are ignored (masked).

Table 3-2 shows the serial poll response byte. Each of the 8 bits represents a condition that, if selected by the SRQ mode, will assert the GPIB's SRQ line and the serial poll byte's rsv bit. Each bit may be selected individually or in various combinations. The rsv bit (bit decimal position 64) and the undefined bits (bit decimal positions 2,4, and 8) will have no affect if selected.

For example, XQ1 dictates that the SRQ line and serial poll byte's rsv bit are asserted when there is a program error; such as, selecting a switch number that does not exist. The serial poll response byte will be 01000001.

Table 3-2. Serial Poll Response Byte

Bit Decimal Position	Bit Binary Position*	Bit Name	Bit Description
128 (MSB)	1000 0000	SRQ key	A control panel key.
64	0100 0000	rsv	Request for service.
32	0010 0000	Execute Complete	Indicates the completion of and execute command.
16	0001 0000	Low Battery	Indicates a low battery level for memory back-up battery.
8	0000 1000	Undefined	Undefined bit.
4	0000 0100	Undefined	Undefined bit.
2	0000 0010	Undefined	Undefined bit.
1	0000 0001	Program Error	Indicates a program error; it can be either class 1 or 3 error (ref: paragraph 3.3.3).

* Binary Code: 1 = Selected, 0 = Not Selected

3.3.11.6 GET Mode

XG followed by its code, selects what actions occur when a Group Execute Trigger (GET) command is sent to the 601. The code may be 0, 1,or −1.

XG0 Upon receipt of GET, the programmed parameter values are transferred to the switch modules.

XG1 Upon receipt of GET, the stored setting next in sequence is recalled and executed.

This is the same sequence of events that would occur if an Increment Recall and Execute (XWI) were programmed.

XG-1 Upon receipt of GET, the stored setting previous in sequence is recalled and executed. This is the same sequence of events that would occur if a Decrement Recall and Execute (WUI) were programmed.

3.3.11.7 Terminator Type

XV followed by a code (0 through 3) designate the End of String (EOS) or terminator character recognized by the 601.

XV0 Selects Line Feed (LF,or $0A_{16}$).
XV1 Selects Carriage Return (CR, or $0D_{16}$).
XV2 Selects both Carriage Return and line Feed (LF and CR, or $0A_{16}$ and $0D_{16}$).
XV3 Selects no terminator character.

On the GPIB, the EOI line is asserted at the same time as the last character is transferred.

3.3.11.8 Increment Recall

XW causes the stored setting next in sequence to be recall and executed. This provides an automatic way to recall a sequence of programs. Only the next consecutive stored setting location is reached; the 601 warps around to the first stored setting. Stored setting 0 is skipped unless it is the only stored setting.

3.3.11.9 Decrement Recall

XU is similar to increment recall (XW),except the stored settings are recalled in descending numeric order.

3.3.12 Control Panel

The following items are unique to the 603 control panel.

3.3.12.1 Control Panel Keys

These keys are unique to the 603 control panel; all other keys are described in the switch parameter sections.

GPIB Address Key (12)

When pressed causes the front panel to display the current GPIB address. It does not allow modification of the GPIB address from the control panel.

GPIB SRQ Key (12)

Generates a service request if SRQ mode has been programmed to allow control panel SRQs and the unit is in local.

GPIB Local Key (12)

Returns the 601 to local, providing local lockout has not been activated.

3.3.12.2 GPIB Status Indicators

The following indicators are located on the 603 control panel. These indicators, when lit, indicate GPIB related functions.

SRQ (1)

Indicates service request is being asserted by the 601.

Remote (1)

Indicates the 601 is under remote control.

Talk (1)

Indicates the 601 is in the Talker Address state.

Listen (1)

Indicates the 601 is in the Listen Address state.

Address (1)

Indicates, when the GPIB Address key is pressed, the two digits (**3**) are displaying the instrument's GPIB address. All switch status indicators are blanked.

3.3.12.3 Switch Status Indicators

Module (2)

This indicator lights when the Module key (**9**) is pressed. It indicates the number shown on the display (**3**) is the selected module number.

Number (2)

This indicator lights when the Number key (**9**) is pressed. It indicates the number shown on the display is the selected switch number.

Closed (2)

Indicates the currently selected switch will be closed after receiving an Execute command. An off lamp indicates the switch will be open after receiving an Execute command.

Delay (2)

This number identifies the time slot in which the selected switch will actuate after the execute command is received. Allowable time slots values are from 0 to 7; each time slot represents approximately 25ms. A Delay mode (**9**) must be selected.

Delay Close (2)

When lit, indicates the delay number applies when the switch is changing from the open to the closed state.

Delay Open (2)

When lit, indicates the delay number applies when the switch is changing from the closed to the open state.

When neither lamp is lit, the delay time is ignored and the switch actuates immediately.

3.3.12.4 Two Digit Display

The two digit display (**3**) serves several functions, it can indicate the GPIB Address, Module, Number, Stored Setting, Recalled Setting, or Deleted Setting. The number displayed relates to the indicator lit.

3.3.12.5 Setting Indicators

Store (4)

Indicates the number shown in the display (**3**) is the last stored setting location.

Recall (4)

Indicates the number shown in the display (**3**) is the stored setting location last recalled.

Delete (4)

Indicates the number shown in the display (**3**) is the stored setting location last deleted.

3.3.12.6 Trigger Indicators

+ (5)

Indicates the 601 responds to a positive transition (TTL level) at the trigger input BNC.

– (5)

Indicates the 601 responds to a negative transition (TTL level) at the trigger input BNC.

When neither + or – is lit, the trigger input is ignored.

3.3.12.7 Error Indicator (6)

Indicates an error. It lights under the following conditions. Anytime an input or low battery error is generated, the control panel generates a low frequency tone for 0.5s.

1. When an input error is made, the error indicator lights and blinks along with the error parameter.

1. When an input error is made, the error indicator lights and blinks along with the error parameter. For example, the key sequence Number 99 Number would cause the Number indicator, the two digit display and the error indicator to blink. Pressing any parameter select key will cause the blinking to stop and the error indicator to go out and the normal display for the selected parameter will be displayed.
2. When attempting to store or recall and the internal battery is sensed to be below the allowable voltage limit, the error indicator blinks and the two digit display (**3**) gives the message LO.

3.3.12.8 Execute Req'd Indicator

Indicates a program has been input but not executed. The displayed information may be different from information in the switching modules.

3.4 601 SIGNAL CONNECTORS

The following connectors are located on the rear panel of the 601.

3.4.1 Trigger Input BNC

A TTL level change or switch closure causes one increment to the next stored setting and performs an execute. This is the equivalent to pressing Recall or Cursor keys.

3.4.2 Trigger Out BNC

A 1ms pulse is generated at the completion of an execute command (after the longest switch delay).

SECTION 4
CIRCUIT DESCRIPTION

4.1 SERIES 600 GENERAL DESCRIPTION

The 600 signal switching system consists of four units (figure 4-1): the 601 main chassis, the 602 expansion chassis, the 603 control panel, and switch modules. Paragraph 4-5 contains a brief switch module circuit description.

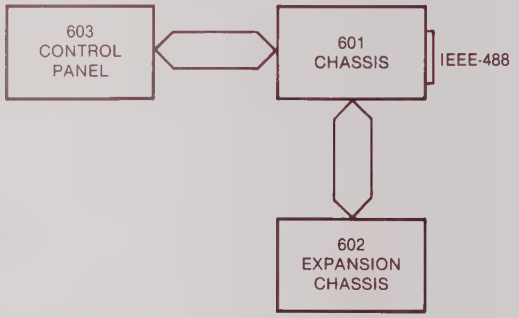


Figure 4-1. 600 System Major Units

The 601 chassis is the basic unit of the system. It contains the intelligence and power supplies for the entire system, as well as, the GPIB interface. In addition, the 601 contains connector ports which, when the cables are connected, supply power and data to the 602 expansion chassis and 603 control panel.

MODEL 601

The Model 601 Programmable Signal Switching System main chassis consists of two major sections (figure 4-2): the microprocessor control section and the connector interface section. Each of these major blocks are described briefly in this general description. The microprocessor control block is described in greater detail in the following section.

Microprocessor Control. The microprocessor is the clearinghouse for all control operations. Through its program in Read-only-memory (ROM), the microprocessor accepts commands from the IEEE-488 GPIB or optional control panel (Model 603), then translates them into internal operating parameters and sends them to switch module circuits or other auxiliary circuits. The microprocessor also stores these parameters in Random-Access-Memory (RAM) and displays them on the optional control panel display (Model 603).

Other functions of the microprocessor control section include power generation and regulation for the entire

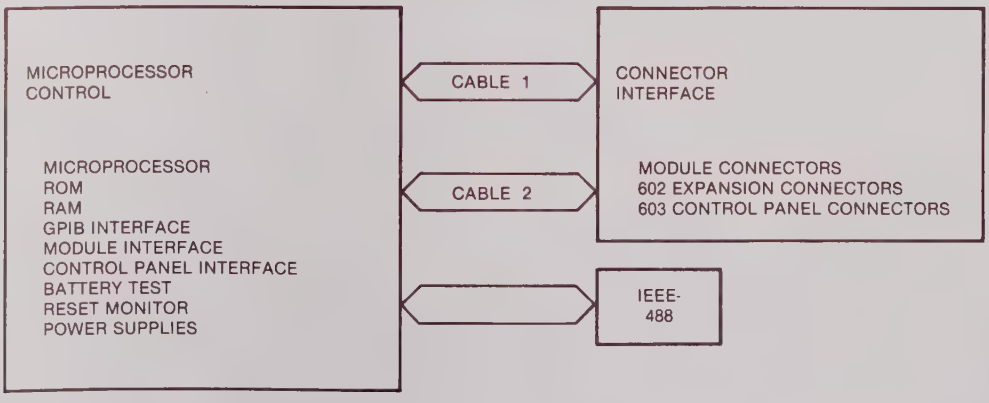


Figure 4-2. 601 Chassis Major Blocks

600 system (including the Models 602 and 603), power monitoring for safe power up or down reset, and low voltage monitor for nonvolatile RAM battery.

Connector Interface. The connector interface provides all I/O connections (except IEEE-488) between the microprocessor control and the rest of the switching system. Two ribbon cables connect all of the microprocessor control I/O signals (except IEEE-488) to the connector interface board. Once on the connector interface board, the signals are routed to the appropriate I/O connector for distribution to the rest of the switching system. Three connectors are provided for switching modules 1,2, and 3. The fourth and fifth connectors distribute power and control signals to the optional expansion chassis (Model 602) and control panel (Model 603).

MODEL 602

The 602 expansion chassis receives its programming information and power via an interconnecting cable from the 601 chassis. The 602's single printed circuit board routes the programming information and power to the modules' card edge connector. (See figure 4-3.)

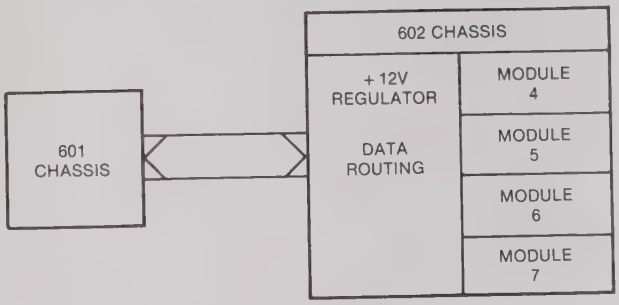


Figure 4-3. Expansion Chassis Block Diagram

MODEL 603

The 603 control panel consists of three circuit blocks: the LED display interface driver, the keyboard and keyboard scanner, and the beeper and beeper control circuits. All power, input data, and output data for the 603 are provided, via an interconnecting cable, from the 601 chassis. (See figure 4-4.)

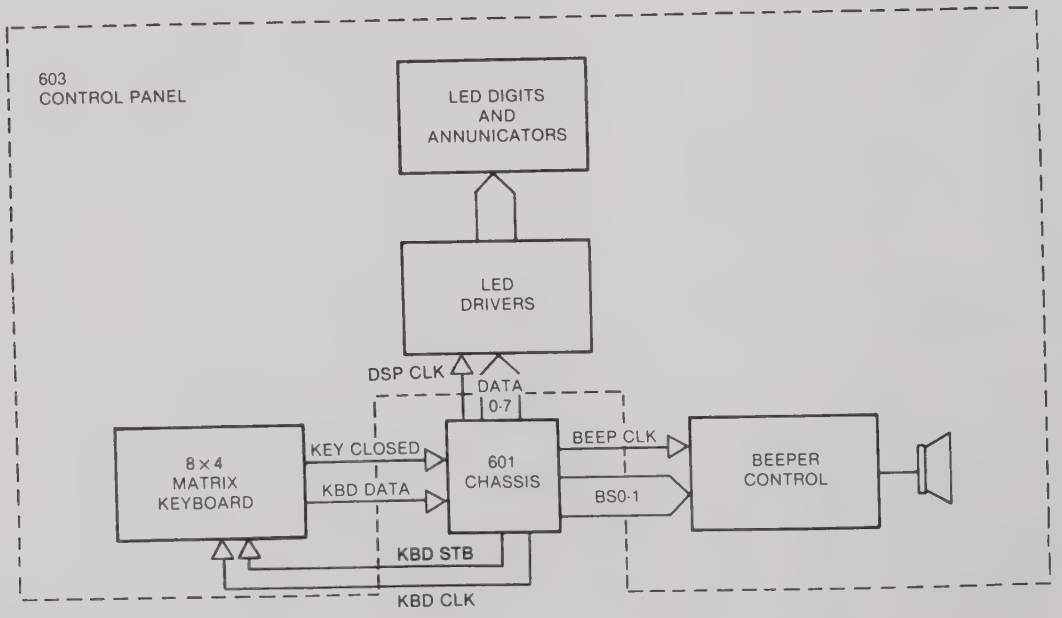


Figure 4-4. Keyboard/Display Block Diagram

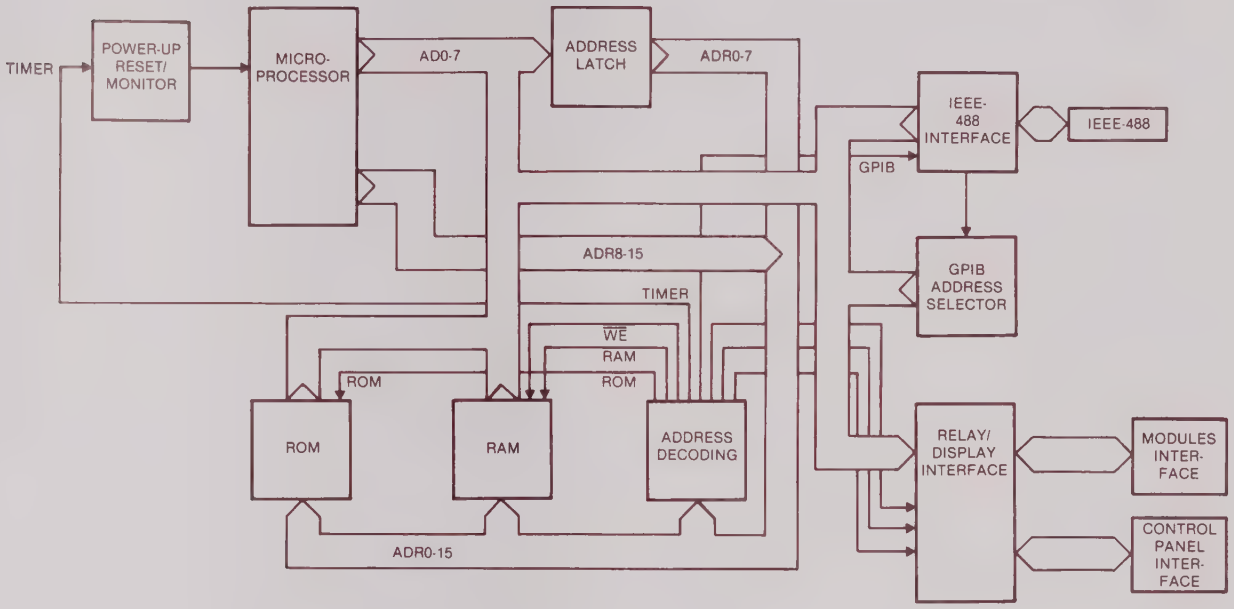


Figure 4-5. 601 Chassis Block Diagram

4.2 MODEL 601 DETAILED DESCRIPTION

The microprocessor control section and its associated circuits (figure 4-5) are located on the GPIB/Microprocessor circuit board accessible beneath the bottom cover of the 601. Descriptions in this section include the microprocessor/memory circuits, GPIB interface, battery test, reset monitor, module interface, and control panel interface.

The following descriptions refer to figure 4-5 and the GPIB/Microprocessor schematics in the back of this manual.

4.2.1 Microprocessor/Memory

The microprocessor/memory section includes the microprocessor itself, an address latch to demultiplex the lower order address bits, an address decoder to select appropriate memory locations and addressable registers, read-only-memory (ROM), random-access-memory (RAM), a data latch to hold data for transfer to module and display register, and the GPIB address switch and register.

Table 4-1. Memory Map

Addressable Devices	Address (Hexadecimal)
Microprocessor Internal Register	0000-001F
GPIB	0020-003F
Relay Control	0040-005F
Relay Data	0060-007F
Internal RAM	0080-00FF
Module Read	0100-011F
Not Used	0120-369F
Watchdog Timer	36A0-36BF
Not Used	3700-3FFF
External Test Program	4000-7FFF
ROM	8000-BFFF
RAM	C000-DFFF
Not Used	E000-FFDF
Vector	FFE0-FFFF

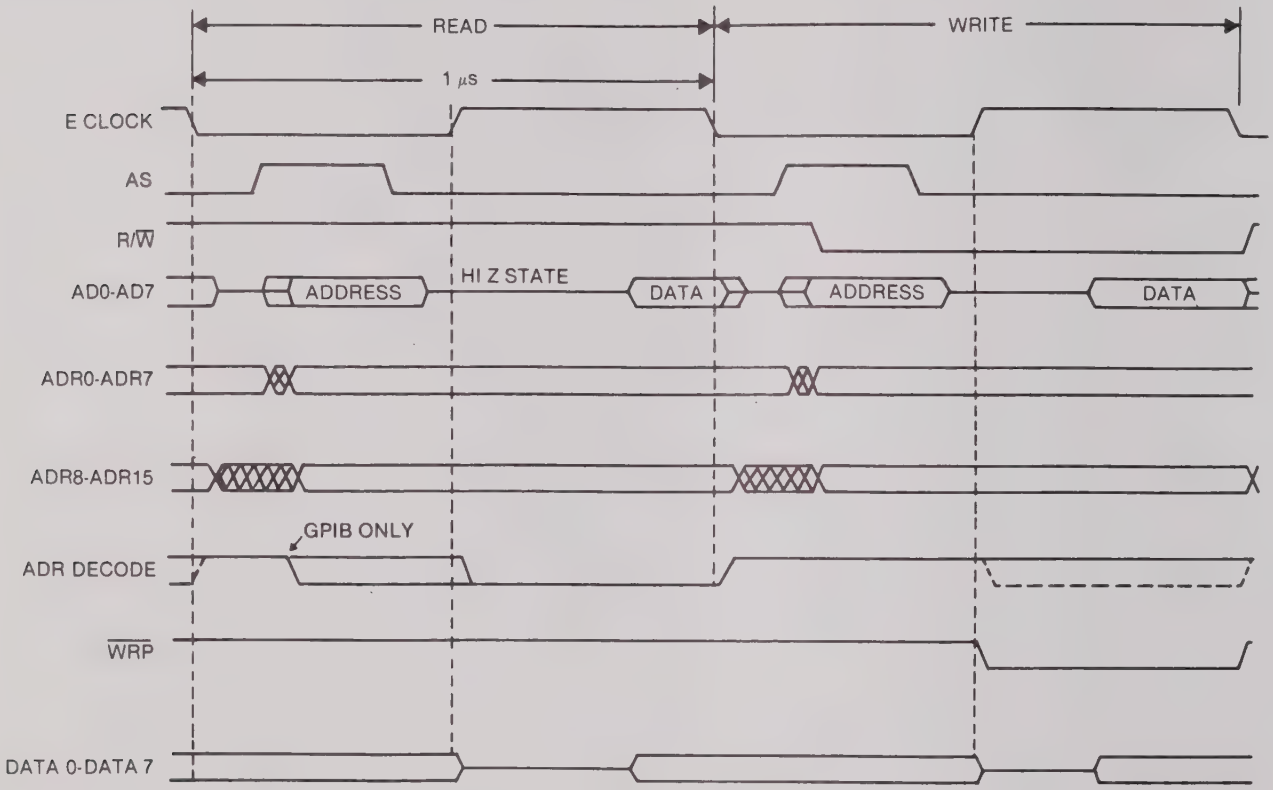


Figure 4-6. Microprocessor Timing Diagram

4.2.1.1 Microprocessor

The 6803 microprocessor, U2, is in its epanded-multiplexed mode (mode 2), as determined by mode control programming diodes, CR3 and CR4. This mode allows the microprocessor to address external memory by using port 3 (P30-P37) as the low-order-address/data bus, port 4 (P40-47) as the high-order-address bus with read/write line (R/$\overline{W}$) respectively. Ports 1 (P10-17) and 2 (P20-24) are always I/O ports.

A clock-generating circuit within the microprocessor uses an external 4MHz crystal, Y1, between the XTAL 1 and XTAL 2 pins to develop its internal phase clock and the 1MHz system enable clock (E). Figure 4-6 shows the approximate timing for major signals and busses in the microprocessor/memory system. Actual system timing varies somewhat from instrument to instrument, so signal spacing may be different within the 1μs period of the system clock.

The microprocessor responds to three interrupt inputs: master reset ($\overline{RESET}$), which initializes the microprocessor; the external interrupt request line (IRQ), which the GPIB interface uses to signal the processor; and the nonmaskable interrupt ($\overline{NMI}$), which is not used in the instrument, but is available on the test connector.

4.2.1.2 Address Latch

An octal latch, U3, demultiplexes the address/data bus from the microprocessor to hold the low-order addresses (ADR0-ADR7) during the part of the E clock cycle that data occurs on the multiplexed bus. Latching occurs on the negative transition of the AS signal (U2 pin 39). See timing diagram, figure 4-6.

4.2.1.3 Address Decoding

A field programmable gate array, U16, decodes the highest of the address lines to select one of eight possible addressable devices or circuits. These are IEEE-488 interface (GPIB), RAM, ROM and the module interface registers. In addition, a vector output

decodes the reset and interrupt vector addresses into ROM for normal operation, but allows a test input to direct these vectors into external memory. A memory map, table 4-1, shows the position in memory for each of the above blocks.

4.2.1.4 ROM

A read-only-memory, U12, contains the program for the microprocessor. The $\overline{ROM}$ line from Address Decoding enables U12 whose output is enabled on the E clocks rising edge.

4.2.1.5 RAM

The microprocessor uses a random-access-memory, U13, as a scratch pad memory and a memory for stored settings. The $\overline{RAM}$ line from address decoding enables the RAM on the rising edge of the E clock. During a write cycle, the address decoder and's the read/write line from the processor (R/$\overline{W}$) with the E clock to generate a write pulse ($\overline{WE}$) after all address lines have become stable. A lithium battery (BT1) maintains a sufficient voltage level to prevent the loss of information stored in RAM when external power is removed. Schottky diode CR8 conducts when the +5V supply falls below the battery's voltage (approximately +3V). Diode CR7 prevents the battery from discharging through the rest of the circuit.

4.2.1.6 GPIB Address

An 8 section DIP switch (SW1), selects the GPIB address for the instrument. Since IEEE-488 specifications allow only 31 possible addresses for GPIB instruments (binary 0-30) only the first five switches are used to select the actual address. The last three switches are not used.

4.2.1.7 Trigger Input

The trigger input signal connects directly to the microprocessor, U2. The microprocessor samples this input to detect a valid trigger signal. Diodes CR1 and CR2 protect the microprocessor from excessive external voltages.

4.2.1.8 Trigger Output

The trigger output signal is generated directly from the microprocessor output port. Diodes CR5 and CR6 protects the microprocessor output from externally applied overvoltages.

4.2.2 GPIB Interface

The GPIB interface section of the microprocessor board interfaces with the instrument's microprocessor and handles all the handshake protocol and data transfer over the IEEE-488 General Purpose Interface Bus (GPIB).

Most of the IEEE-488 instrument bus protocol functions are handled by the General Purpose Interface Adapter (GPIA), a single IC, U5. Data and control portions of the bus require high current driving capability and specific line termination which the Bus Drivers, U6 and U7, provide. These two sections of the bus have different requirements depending on whether the instrument is acting as a talker or a listener: the data transceiver, U6, always acts as a transmitter during talk modes and a receiver during listen modes, but the control transceiver, U7, requires that some lines transmit while other receive in both of these modes. These different requirements are met by using different parts for each function (the 75160A for data and the 75161A for control).

The IEEE-488 interface IC, U5, does all the handshaking requirements of the 1978 IEEE-488 standard. When the controller on the bus sends either the instrument's talk or listen address or a serial poll, U5, signals the instrument's microprocessor by asserting the interrupt request line, $\overline{IRQ}$ (a low on U5 pin 40). The processor can then interrogate any of the eight registers internal to U5. Data from the IEEE-488 bus (listen mode) is accessed by reading from the data register in U5; data output (talk mode) is written to the same register. The address strobe enable line ($\overline{ASE}$) from the interface IC, U5, controls the select line to U4 that enables the GPIB address switch, SW1. The microprocessor can read this switch by a read of the address register in U5 which causes U5 to set $\overline{ASE}$ low during the E clock (data) portion of the microprocessor clock cycle. The address is stored in U5 by writing into the internal address register.

For a complete definition of the GPIB lines, refer to paragraph 3.3.11 in the OPERATION section of the manual.

4.2.3 Microprocessor Software

Although a detailed description of software is beyond the scope of this manual, some discussion of the microprocessor operation is helpful in understanding how the instrument functions.

Figure 4-7 shows the three main program loops for microprocessor operation: a fast background loop, slow background loop, and parser-procedure loop. The background loops only check registers for interrupt flags set by external or timer interrupts. The parser selects and calls procedures when the program enters it, and returns control to the fast background loop when a procedure is finished.

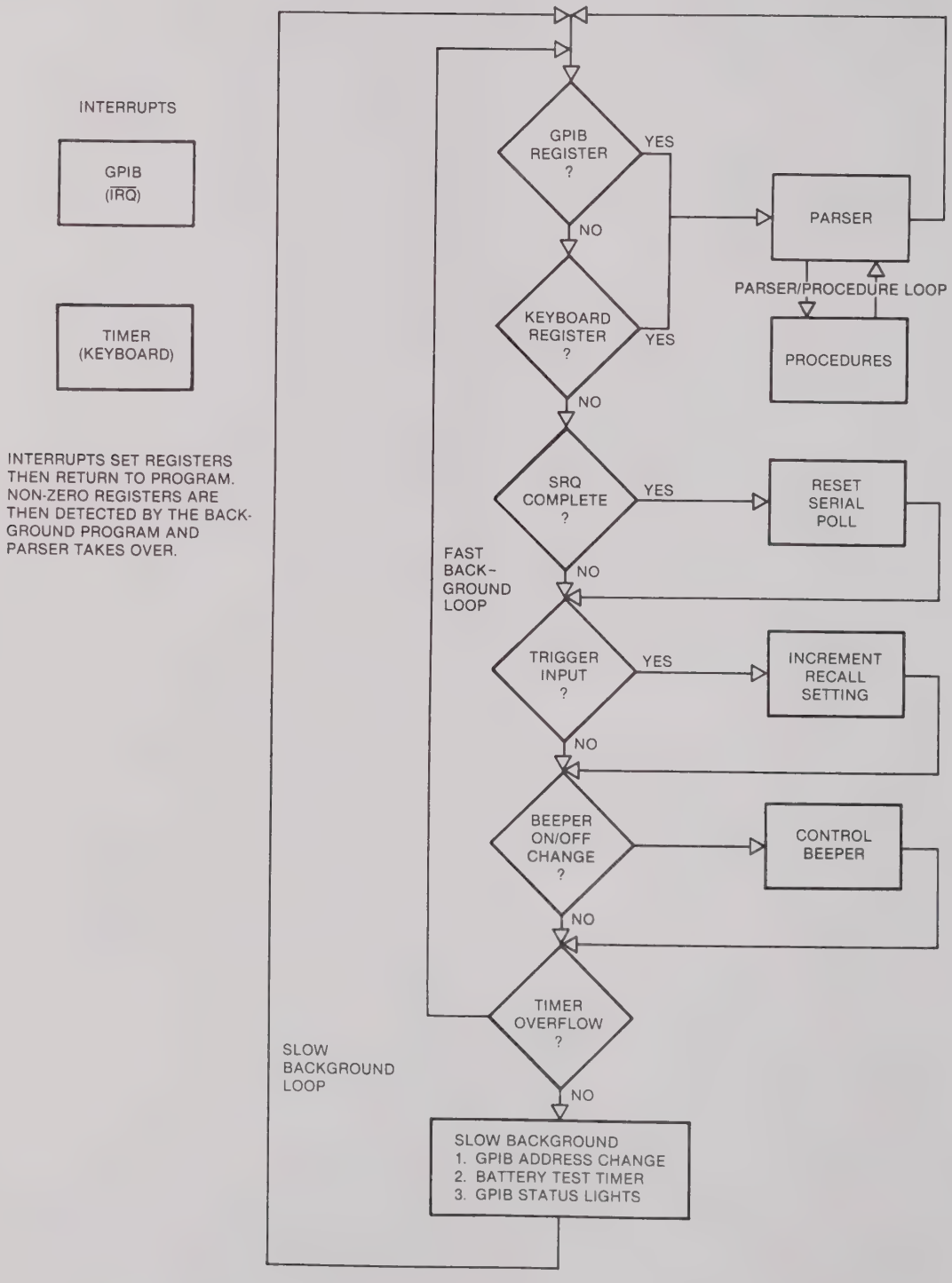


Figure 4-7. Program Loop

4.2.3.1 Fast Background

The fast background loop inspects the six internal registers (GPIB, Keyboard, SRQ, Trigger, Beeper, and timer) for interrupt flags (non-zero status) and then returns to its beginning. If no interrupt flags are set the entire loop takes about 50 to 60μs. If a flag is set, the loop time increases by the length of the interrupt procedure. If either of the first two register flags are set, the background program calls the parser. If the timer register flag is set, the program enters the slow background loop.

4.2.3.2 Slow Background Loop

The timer flag in the fast background loop looks for an overflow in the 2^{16} bit; (which occurs about every 66ms) of the timer clock (part of the microprocessor IC). The slow background loop then examines a series of other registers: GPIB address change, battery test timer, and GPIB status lights.

4.2.3.3 Parser/Procedure

The parser handles all programming chores except short housekeeping routines. When the parser is called, it examines a series of registers and decides which routines are required, then calls the required procedure which, when complete, returns control to the parser. When the parser has scanned all inputs, it returns control to the fast background. Even if their functions appear simple, the parser and the procedures with their interpretive functions make up the bulk of the program.

4.2.3.4 Interrupts

There are only two ways the processor program can be interrupted: through $\overline{IRQ}$ (generated by the GPIB interface) or through an internal timer (used for all other interrupt requirements).

GPIB Interrupts — GPIB interrupts are initiated by the GPIB responding to GPIB bus commands. When the interrupt occurs, a byte is read from the GPIB interface and stored in a register. The program then returns to its preinterrupt position. It is the fast background program that actually inspects the register and passes control to the parser, which in turn decides what routines are called to process the information.

Timer Interrupts — Keyboard scans are run during initial power-up and periodically during the time the instrument is on. These subroutines are initiated when the number in the clock register (within the microprocessor) matches the preset number in timer register (within the microprocessor). Upon completion of the subroutine, the preset number corresponding to the elapsed time required between successive interrupts for the function is again added to that interrupt register. The clock timer continues to increment its own register, and when the number in this register again matches the interrupt registers, the subroutine is initiated. These interrupt registers work independently of each other and may set another register (as in the keyboard interrupt) or they may initiate an entire subroutine.

4.2.4 Module Interface

Data is written to and read from each module serially. Data latch, U10, has one output line dedicated to each of the possible seven modules. DATA 0 is the serial output to module 1, DATA 1 to Module 2, etc. Relay control latch, U8, provides the control signals for clocking, strobing, and resetting serial output to the modules ($\overline{RLY\ RST}$, RLY STB, and RLY CLK).

Serial output from each module (consisting of module identification codes) is wire ORed and returned to the microprocessor, U2, on a single input line. Module identification can be read one at a time by first enabling the desired module serial output and then clocking the module. The data latch, U14, provides the required output enable signals and U8 provides the clock.

4.2.5 Control Panel Interface

The control panel interface consists of three parts: the keyboard input interface, the display output interface, and the beeper interface. The clock for the beeper is provided directly from the microprocessor U2. Beeper tone control comes from data latch U8 (signals BS0 and BS1). Keyboard input is detected by the microprocessor input port 11 and data is returned serially on port 16. Data latch, U8, provides the required control signals (KBD STB and KBD CLK). Display information is written to the control panel from data latch, U10. Data latch, U8, provides the clock (DSP CLK).

4.2.6 Battery Test

The battery test circuit consists of a single voltage comparator, U17D. A battery test is performed approximately every 10 minutes. The microprocessor, U2, provides a small current load on the battery via port 15 and R29 a 100kΩ resistor. While the battery is under load, the output of the voltage comparator is examined by the microprocessor via port 14 to detect if the battery is below the required +2.2V minimum. The test is completed in less than 200mS and the load on the battery is removed.

4.2.7 Power-up/Reset Monitor

The reset monitor ensures proper system reset at power up or down. It also reacts to power line faults by generating a system reset ($\overline{MR}$) and thereby inhibiting memory access and turning off all relays. The monitor consists of two parts: a system power monitor and a watchdog timer.

The system power monitor consists of voltage comparators, U17A and B. Any sudden changes in power supply voltage greater than 500mV will cause the comparator output to go low, thus generating a system reset.

The watchdog timer consists of counter, U18, and comparator, U17C. This circuit detects nonoperational microprocessor failures. Once system power is applied, the microprocessor periodically resets the counter. If the microprocessor is not functioning, the counter is incremented by an internal oscillator until an overflow on U18 pin 2 occurs. This causes the comparator U17C to go low, which generates a system reset.

4.2.8 Power Supplies

4.2.8.1 Primary Power

The 601 power switch interrupts the primary ac input to the 600 system. With the 603 control panel disconnected or the 603 power switch on, the relay, K1, connects the secondaries to the rest of the supply circuits. Placing the 603 power switch in standby (Stby) energizes K1 opening the secondary connection to the supply circuits.

4.2.8.2 Power Supplies

Three power supply voltages, a single +5V and two +12V, are generated on the GPIB/Microprocessor circuit board. The pass elements are three-terminal regulators (VR1, VR2 ,and VR3) that normally operate with a 1.25V difference between their output and reference terminals.

+5V — In the +5V supply (GPIB/Microprocessor schematic sheet 2), ac from the transformer, T1, is rectified by CR9 and filtered by C17, C18, C19, C20, and C21 to provide unregulated dc for the regulator, VR1. A resistive divider, R17 and R18, sets the voltage at the reference input, pin 1, to provide an output of +5V at E2, while C22 and C23 provide additional filtering at the output of the regulator. CR11 prevents C23 from discharging back through the regulator when power to the instrument is turned off.

+12V — To divide the load, there are two +12V supplies: one supplies power to the microprocessor/GPIB board and module 1, and the other supplies power to modules 2 and 3.

Both +12V supplies operate much the same as the +5V supply, except the unregulated dc input (pin 3 of VR2 and VR3) is much higher and the resistor divider to the regulator reference input is scaled to +12V.

4.3 MODEL 602 DETAILED CIRCUIT DESCRIPTION

The single printed circuit board routes data to and from the switch module edge connectors.

Also, two +12V supplies are generated on the 602 mother board. The pass elements for the supplies are three-terminal regulators (VR1 and VR2) that normally operates with a 1.25V difference between their output and reference terminals.

The regulators, both are identical, use a single resistor divider to to set the reference voltage at VR1 and VR2 pins 1. Both regulators receive their unregulated +18V input from the 601 chassis. The unregulated input is fused; a 1.5A fuse accessible by removing the top cover. Diode CR1 or CR2 prevents the capacitor (C3 or C7) from discharging back through the regulator when the power is turned off. Resistors R3 or R6 provide minimum current loads to guarantee operation even when the modules are not installed.

4.4 MODEL 603 DETAILED CIRCUIT DESCRIPTION

The LED display interface consists of five TTL 8-bit latches. The microprocessor, located on the 601, shifts byte-serial data into the latches. These latches directly drive the LED segments.

The keyboard and keyboard scanning circuits consist of a key closed detector and shift registers which determine the matrix position of the key. The microprocessor periodically polls the key closed line. If a key is closed, the shift register is latched and the microprocessor reads the register to determine the exact key pressed.

The beep circuits consist of the tone select logic and beeper driver. The microprocessor, located on the 601, provides the clock for the tone time base. A beep is generated by selecting the desired tone (1kHz or 2kHz), then generating the tone time base for the proper length of time.

4.5 SWITCH MODULES

All switch modules interface to the microprocessor in the same way. Their circuits receive data from the

Table 4-2. Relay Module ID Code

Module	Number of Relays	Module Number 8 H	4 G	2 F	1 E	Number of Relays 16 D	8 C	4 B	2 A	1 SI
610 200 MHz 10 Channel	11	0	0	0	0	0	1	0	1	1
611 500 MHz 10 Channel	11	0	0	0	1	0	1	0	1	1
612 250 MHz 4×4 Matrix	16	0	0	1	0	1	0	0	0	0
613 16 Channel Driver	16	0	0	1	1	1	0	0	0	0
614 High Power	5	0	1	0	0	0	0	1	0	1
615 Low Level 10 Channel	10	0	1	0	1	0	1	0	1	0
616 18 GHz 2 Channel	2	0	1	1	0	0	0	0	1	0
618 1.5 GHz Dual 1 of 4	10	1	0	0	0	0	1	0	1	0

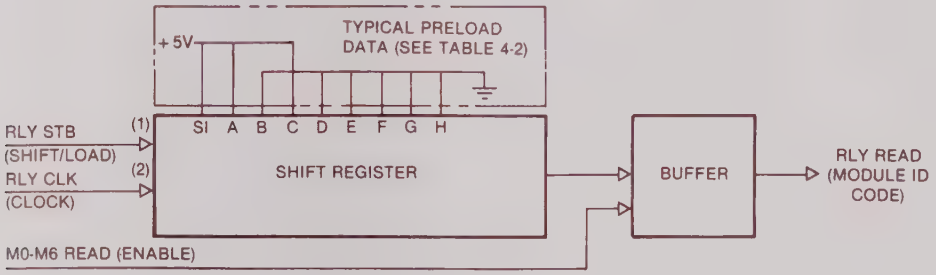


Figure 4-9. Switch Module ID

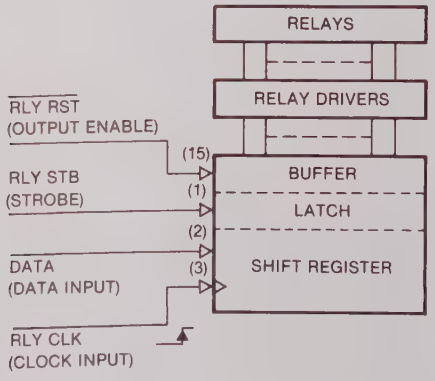


Figure 4-8. Switch Module

601's microprocessor section, decode the data, and activate the appropriate relays or switches. Each module sends back to the microprocessor a serial module identification code (see table 4-2).

4.5.1 Register/Relay Driver

This circuit consists of shift registers and relay drivers. Each register contains the actual shift register stage plus a latch and buffer stage. The QS output can be cascaded to the D input of the next register if more than one register is required. The 20 bit serial data (DATA) enters the shift register (see figure 4-8) at pin 2 on the rising edge of the RLY CLK (pin 3). Next, RLY STB (strobe) transfers the data into the latches after receiving all 20 bits. This changes the state of the switches or relays when $\overline{\text{RLY RST}}$ is high. But if $\overline{\text{RLY RST}}$ is low (power on and reset), the shift register forces all relays or switches open.

4.5.2 Switch Module ID Code

This circuit consists of a shift register and output buffer. The shift register (see figure 4-9) generates a 9 bit module ID code. The code for each module is hard-wired to the shift register's parallel data inputs. Each code consist of two parts: 4 bits identify the module number and 5 bits give the number of switches (relays) in the module (see table 4-2). Notice that the serial input is used as the data input for the 9th bit. When RLY STB (pin 1) goes low, the code is loaded into the register. Next, RLY STB returns high, thus allowing the data to be shifted out of the register on the rising edge of the clock pulse. Also, to transfer the code back to the microprocessor, the M0-M6 READ line must be enabled.

SECTION 5
MAINTENANCE/REPAIR

5.1 CALIBRATION

The Models 601 Chassis, 602 Expansion Chassis, and 603 Control Panel require no calibration. If, for any reason, any of these units fail to function correctly, refer to paragraph 5.3, Troubleshooting, or return the unit to Wavetek for repair.

5.2 FACTORY REPAIR

Wavetek maintains a Customer Service department. If an instrument is returned to Wavetek for repair, a detailed description of the specific problem should be attached to the unit to minimize turnaround time.

5.3 BEFORE YOU START

Since no troubleshooting guide can possibly cover all potential problems, the aim of this guide is to give a methodology which, if applied consistently, will lead to the problem area. Therefore, it is necessary to familiarize yourself with the instrument by reviewing the functional description and the detailed circuit description in conjunction with the schematic. Successful troubleshooting depends upon understanding the circuit operation within each functional block as well as the block relationships.

5.4 TROUBLESHOOTING

Table 5-1 gives an index of common symptoms. For each symptom a troubleshooting step is referenced that will aid in the solution of the problem. Individual component troubleshooting is given in paragraph 5.5, recommended test equipment is given in paragraph 5.6, and circuit schematics are in the back of this manual.

In all problems:

1. Double check for proper parameter settings.
2. Verify power supplies are in specification.
3. Inspect components, wiring, and circuit boards for heat damage.

Find the instrument symptom in table 5-1 and proceed as directed to the proper troubleshooting step. After verifying the referenced step is okay, proceed to the following step unless directed otherwise.

Table 5-1 Symptoms

Symptoms	Step in Table 5-2
Display does not light	1.1-1.3
Display incorrect at power up	2.1-2.2
Low (Lo) battery indicated	3
Keyboard has no effect	4.1-4.2
Cannot recall stored settings	5
Will not work on GPIB	6
No or incorrect Trigger Output	7
Does not respond to Trigger Input	8
Incorrect module identification on power up	9
Cannot correctly control switches on module	10

5.5 TROUBLESHOOTING INDIVIDUAL COMPONENTS

5.5.1 Digital TTL IC's (e.g. 7400 series)

1. The correct operating voltage for the output high state is $> +2.4V$ and low state is $< +0.5V$.
2. The input must show the same two levels as in step 1. If the levels are between $+0.8V$ and $+2V$, the connection to the driving circuit output is open.

5.5.2 Three-Terminal Voltage Regulator

1. To operate correctly, the control pin must be 1.25V less than the output pin.
2. Also, the input pin must be at least 2V greater than the output pin.

5.5.3 Capacitor

1. Shorted capacitors have 0V across their terminals.
2. Open capacitors usually can be located by using a good capacitor connected in parallel with the

capacitor under test and observing the resulting effect.

5.5.4 Diodes

A signal diode is defective if there is a greater than 1V (typically 0.7V) forward bias across it. Light emitting diodes (LED) operate with a 1.2 to 2V forward bias.

5.6 REQUIRED TEST EQUIPMENT

Oscilloscope . . . . . Bandwidth >10 MHz.
Digital Voltmeter . . . . . Ohms and dc volts.

Table 5-2. Troubleshooting

Step	Symptom	Check	Reference Paragraph	Major Components	Schematic (No./Sheet/ Location)
1.1	Display does not light.	AC Power	—	—	—
		a. Power Source	2.2.2	—	1200/D-3
		b. Power Cord	2.2.2	—	1200/D-3
		c. Power Fuse	2.2.2	—	1200/D-3
		d. Power Selection	2.2.2	—	1200/D-3
		e. Power Switch	4.5.8.1	—	1200/D-3
1.2		DC Power			
		a. +5V supply	4.5.8.2	VR1, C16-23, CR9-CR11, K1, R17, R18	1129/2/D5-8
		b. +12V supply	4.5.8.2	VR2, VR3, F1, C24-C30, K1, CR12-CR18, R19-R22	1129/2/C5-8
1.3		Control Panel Connector	—	J1	
2.1	Display incorrect at power up.	Microprocessor			
		a. Reset Circuit	4.5.7	U16-U18	1129/2/C2-3, B8
		b. E-clock	4.5.1.1	U2, U1A	1129/1/C7, D6
		c. Address Strobe (AS)	4.5.1.1	U2	1129/1/C7
		d. Address/Data Bus (AD)	4.5.1.1	U12, U13, U5, U9, U4, U3	1129/1
		e. Address Bus (ADR)	4.5.1.2	U2, U3, U16, U12, U13	1129/1, 2
2.2		Control Panel			
		a. Display Driver	4.4, 4.7	U9-13	1142/1
		b. Display	4.4, 4.7	U1-3, CR1-16	1142/1
		c. Connector Cable	—	J1	1142/1
3	LO battery indicated.	Battery Backup			
		a. Battery below <2.4V	4.5.6	BT1, CR7, CR8	1129/1
		b. Battery Defect	4.5.6	U17D	1129/1
4.1	Keyboard has no effect.	Microprocessor Board			
		a. I/O Control	—	U8-U10	1129/1
		b. Keyboard detect	—	U8	1129/1
4.2		Control Panel	4.5.5	U16-U18	1142/1
5	Cannot recall stored setting.	Stored Settings			
		a. Battery Backup	4.5.1.5	BT1, U17-D	1129/2
		b. RAM	4.5.1.5	U13	1129/1

Table 5-2. Troubleshooting (continued)

Step	Symptom	Check	Reference Paragraph	Major Components	Schematic (No./Sheet/ Location)
6	Won't work on GPIB.	GPIB a. Address Swtich b. Interface	 4.5.1.6 4.5.2	 SW1, U4 U5-U7	 1129/1 1129/1
7	No or incorrect Trigger Output.	Trigger Output	4.5.1.8	U2, CR5, CR6	1129/1
8	Does not respond to Trigger Input.	Trigger Input	4.5.1.7	U2, CR1, CR2	1129/1
9	Incorrect module identification at power up.	Module interface Module	4.5.4 4.8.2	U8, U14 See module schematic	1129/1
10	Cannot correctly control switches on module.	Module interface Module +12V on 602	4.5.4 4.8.1 4.6	U8-U10 See module schematic F1, CR1, CR2, VR1, VR2	1129/1 1138/1

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SECTION 6
PARTS AND SCHEMATICS

6.1 DRAWINGS

The following assembly drawings (with parts lists) and schematics are in the arrangement shown below.

NOTE

Schematics, assembly drawings, and parts lists for the switch modules are located in Appendix A of this manual.

6.2 ADDENDA

Under Wavetek's product improvement program, the latest electronic designs and circuits are incorporated into each Wavetek instrument as quickly as development and testing permit. Because of the time needed to compose and print instruction manuals, it is not always possible to include the most recent changes in the initial printing. Whenever this occurs, addendum pages are prepared to summarize the changes made and are inserted immediately inside the rear cover. If no such pages exist, the manual is correct as printed.

6.3 ORDERING PARTS

When ordering spare parts, please specify part number, circuit reference board, serial number of unit, and, if applicable, the function performed.

NOTE

An assembly drawing number is not necessarily the assembly part number. However, the assembly parts list number is the assembly part number.

DRAWING	DRAWING NUMBER
Instrument Schematic	0004-00-0212
601 GPIB/Microprocessor Assembly	1100-00-1129
601 GPIB/Microprocessor Schematic	0103-00-1129
601 GPIB/Microprocessor Parts List	1100-00-1129
601 Mother Board Assembly	1100-00-1137
601 Mother Board Schematic	0103-00-1137
601 Mother Board Parts List	1100-00-1137
601 Chassis Assembly	0102-00-1145
601 Chassis Parts List	1101-00-1145
601 Chassis Subassembly	1206-00-1200
602 Mother Board Assembly	1100-00-1138
602 Mother Board Schematic	0103-00-1138
602 Mother Board Parts List	1100-00-1138
602 Expansion Chassis Assembly	0102-00-1140
602 Expansion Chassis Parts List	1101-00-1140
603 Keyboard/Display Assembly	1100-00-1142
603 Keyboard/Display Assembly	0101-00-1142
603 Keyboard/Display Schematic	0103-00-1142
603 Keyboard/Display Parts List	1100-00-1142
603 Subpanel Assembly	1206-00-1144
603 Subpanel Parts List	1206-00-1144

DRAWING	DRAWING NUMBER
603 Front Panel Assembly and Parts List	0102-00-1143
601/602 Expansion Chassis Switch System Assembly	0002-00-0210
601/603 Control Panel Switch System Assembly	0002-00-0211

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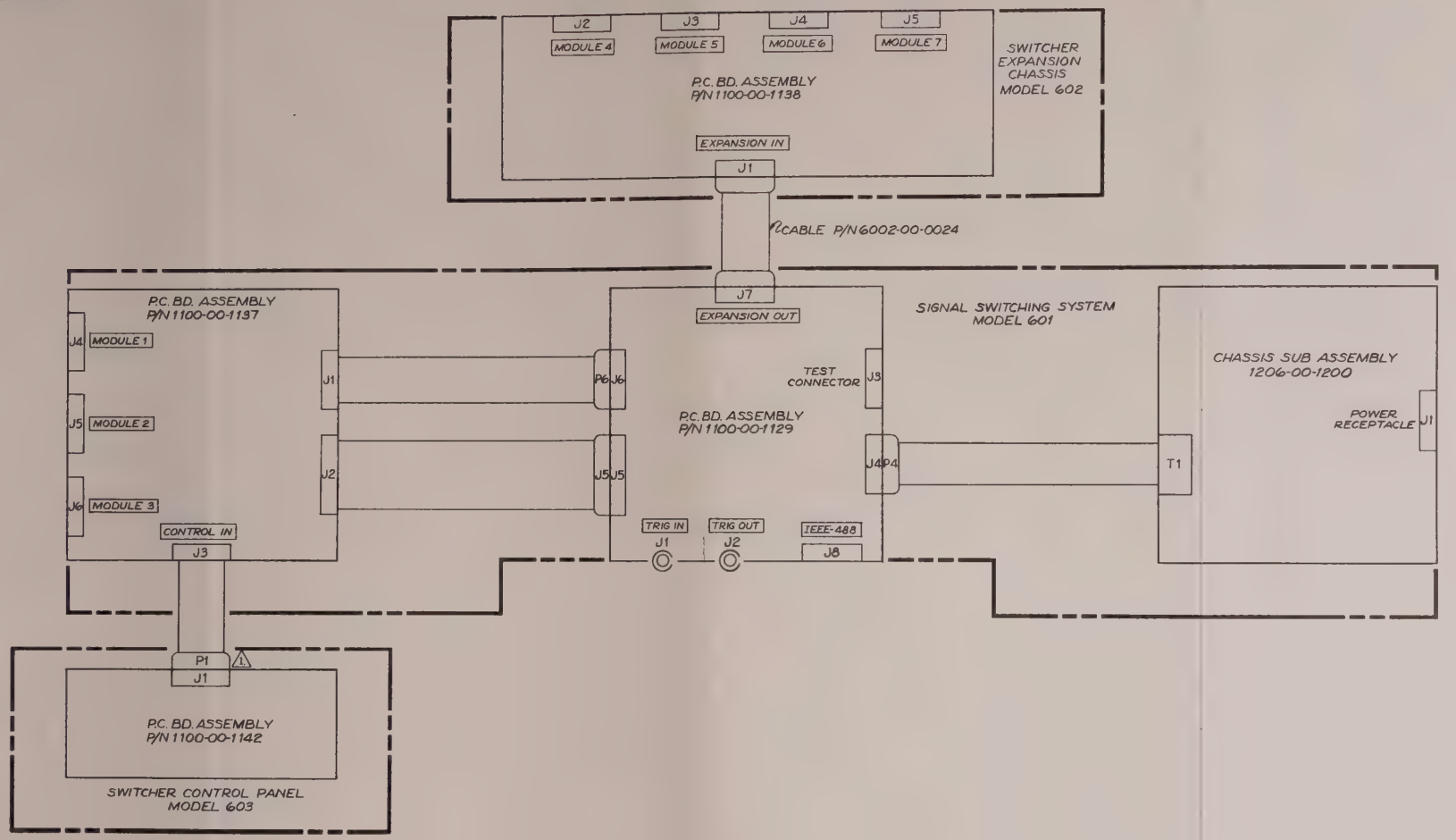

⚠1 CABLE ASSY P/N 6002-00-0026 MAY BE USED BETWEEN P1 AND J1 IF RACK APPLICATION REQUIRES ADDITIONAL LENGTH CABLE.

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN CHERMACK	DATE 10-24-83	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR	11/8/83	TITLE: SCHEMATIC, INSTRUMENT
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1 XX ± .030		
	DO NOT SCALE DWG	MODEL NO 600 SERIES	DWG NO 0004-00-0212 REV A
	SCALE	CODE IDENT 23338	SHEET 1 OF 1

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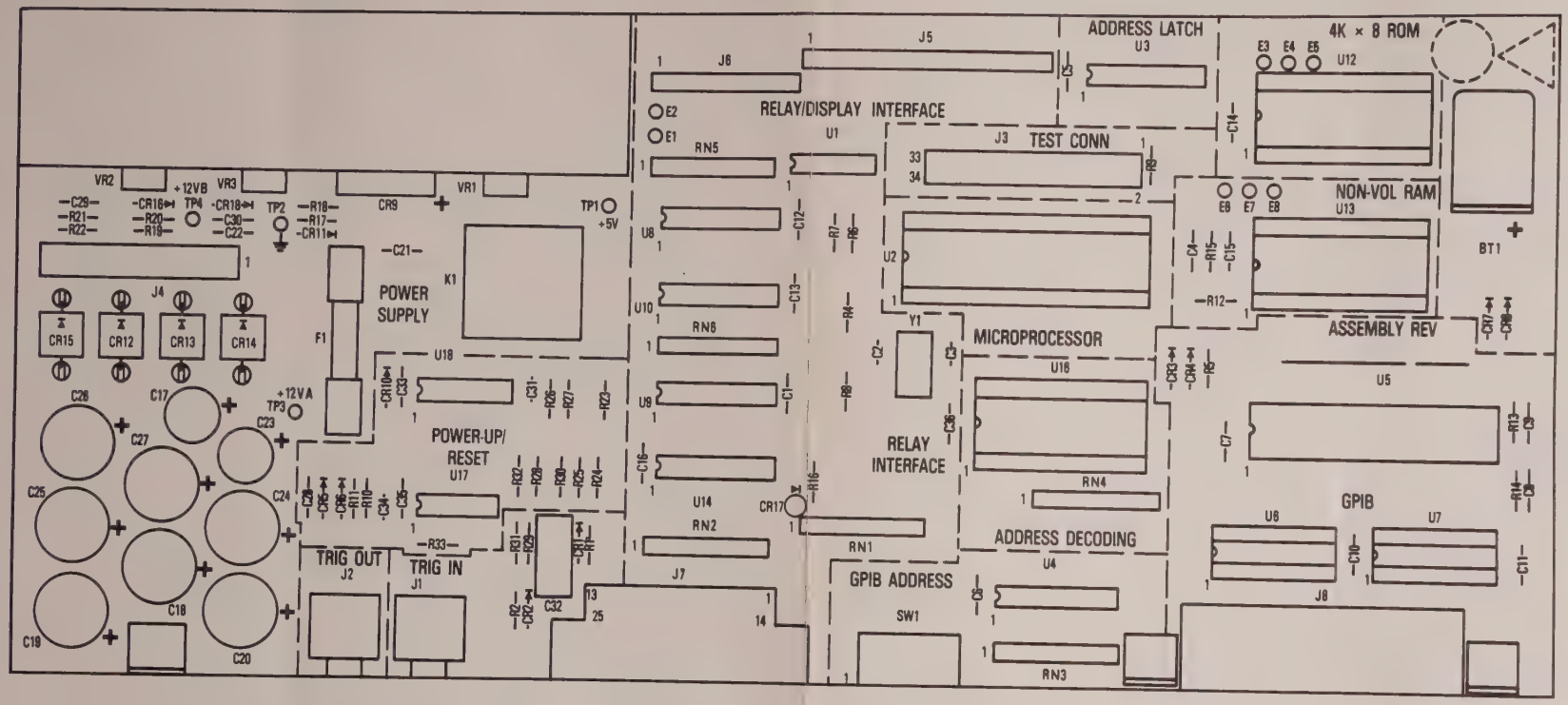

WAVETEK SAN DIEGO • CALIFORNIA	
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MODEL NO 601	DWG NO 1100-00-1129 REV
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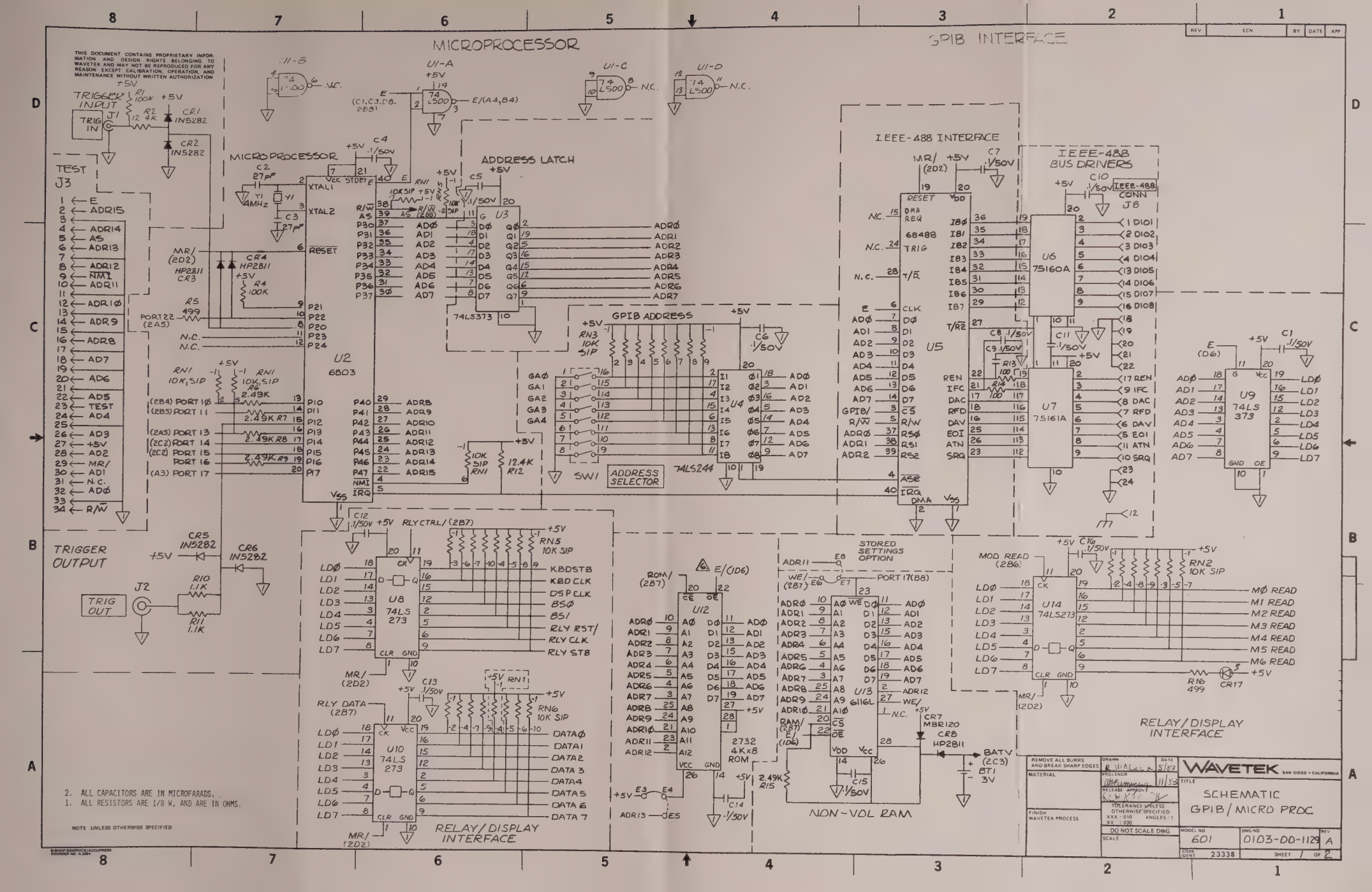
MICROPROCESSOR
GPIB INTERFACE
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TRIGGER INPUT
TRIG IN
J1
CR1 IN5282
CR2 IN5282
TEST J3
MICROPROCESSOR
ADDRESS LATCH
GPIB ADDRESS
SW1
ADDRESS SELECTOR
IEEE-488 INTERFACE
IEEE-488 BUS DRIVERS
IEEE-488 CONN J8
TRIGGER OUTPUT
TRIG OUT
J2
CR5 IN5282
CR6 IN5282
RELAY/DISPLAY INTERFACE
STORED SETTINGS OPTION
NON-VOL RAM
BAT V (2C3) BT1 3V
2. ALL CAPACITORS ARE IN MICROFARADS.
1. ALL RESISTORS ARE 1/8 W, AND ARE IN OHMS.
NOTE UNLESS OTHERWISE SPECIFIED
WAVETEK SAN DIEGO • CALIFORNIA
SCHEMATIC GPIB/MICRO PROC.
MODEL NO 601
DWG NO 0103-00-1129
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SHEET 1 OF 2

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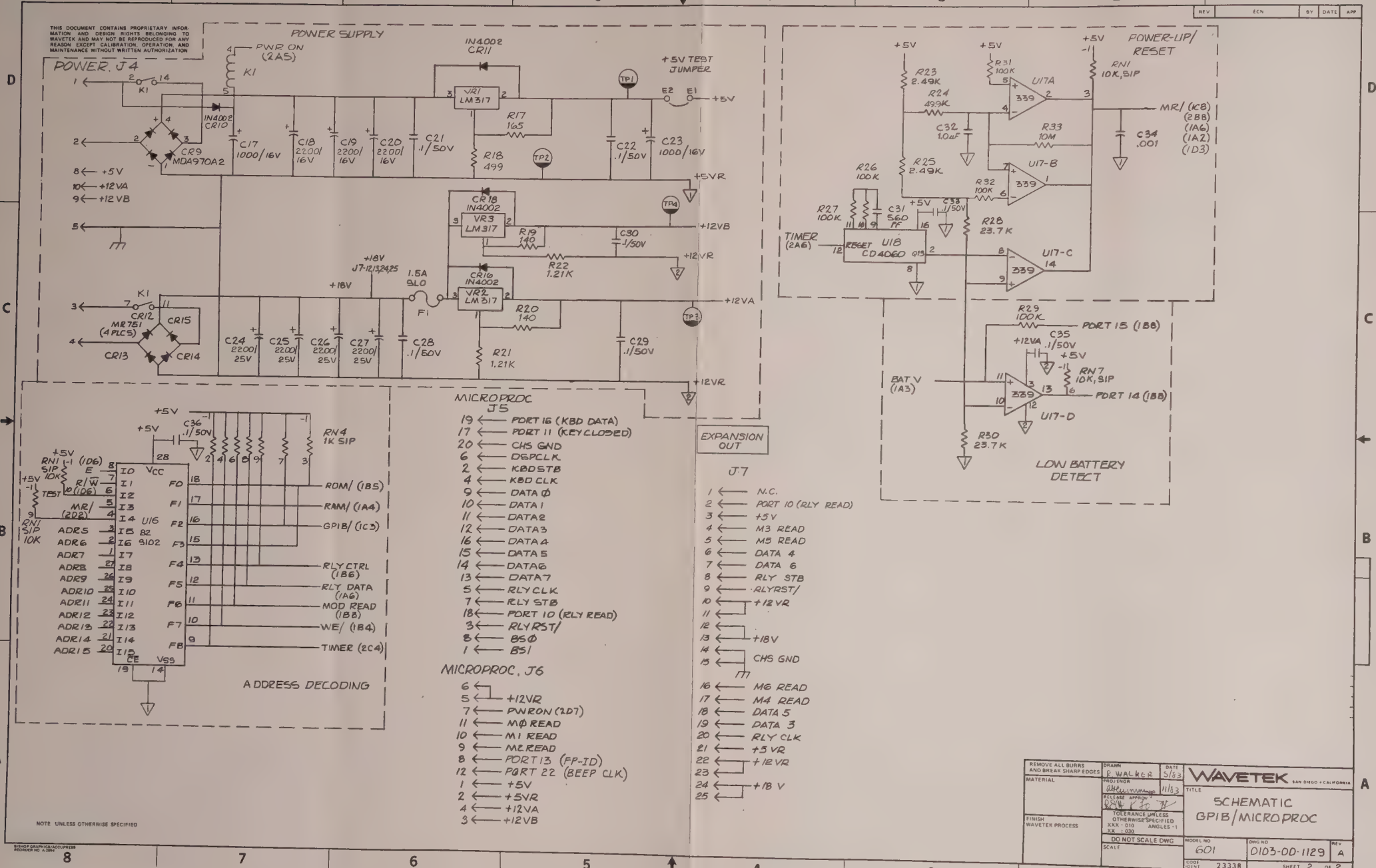

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG, GPIB/MICRO PROC	0101-00-1129	WVTK	0101-00-1129	1
NONE	SCHEMATIC, GPIB/MICRO PROC	0103-00-1129	WVTK	0103-00-1129	1
19	JACK SCREW	1400-01-0530	WVTK	1400-01-0530	2
1	HEATSINK	1400-01-6423	WVTK	1400-01-6423	1
2	PLATE, CONN	1400-01-6842	WVTK	1400-01-6842	1
C34	CAP, CER, .001MF, 1KV	DD-102	CRL	1500-01-0211	1
C1 C10 C11 C12 C13 C14 C15 C16 C21 C22 C28 C29 C30 C33 C35 C36 C4 C5 C6 C7 C8 C9	CAP, CER, MON, .1MF, 50V	CAC03Z5U104Z050A	CORNG	1500-01-0403	22
C31	CAP, CER, 560PF, 1KV	DD-561SLL	CRL	1500-05-6101	1
C2 C3	CAP, MICA, 27PF, 300V	DM15-270J	ARCO	1500-12-7000	2
C17 C23	CAP, ELECT, 1000MF/16V RADIAL LEAD, SP .20	CRE SERIES 1000/16	CAPAR	1500-31-0211	2
C18 C19 C20	CAP, ELECT, 2200MF, 16V RADIAL LEAD, SP .30	CRE SERIES 2200/16	CAPAR	1500-32-2201	3
C24 C25 C26 C27	CAP, ELECT, 2200MF, 25V RADIAL LEAD	CRE SERIES 2200/25	CAPAR	1500-32-2202	4
C32	CAP, MYLAR, 1MF, 100V	PMT2R1.0K100	ITT	1500-41-0524	1
3	GPIB/MICRO-PROC BD	1700-00-1129	WVTK	1700-00-1129	1

WAVETEK PARTS LIST | TITLE: PCA, GPIB/MICRO-PROC | ASSEMBLY NO: 1100-00-1129 PAGE 1 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
J1 J2	CONNECTOR, BNC(PC)	227161-1	AMP	2100-01-0019	2
J4	CONN HEADER	09-60-1101	MOLEX	2100-02-0088	1
J8	CONNECTOR, 24 PIN PC (GPIB)	552791-2	AMP	2100-02-0126	1
J7	CONNECTOR, D, 25 PIN RIGHT ANGLE, PC MOUNT	DBRST25RA02	VKING	2100-02-0149	1
J5	HEADER, 20 PINS	929834-01-20	APTRN	2100-02-0152	1
J6	HEADER, 12 PINS	929834-01-12	APTRN	2100-02-0153	1
4	SKT, IC, 40PIN	DILB-40P-108	BURND	2100-03-0030	1
5	SOCKET, 20 PIN	DIBL-20P-108	BURND	2100-03-0051	2
6	SKT, IC, 28PIN	DILB-29P-108	BURND	2100-03-0055	3
TP1 TP2 TP3 TP4	BUSS BAR STANDOFF	2110-001	ARTWR	2100-05-0024	4
J3	HEADER, 34 PIN	929836-01-17	AP	2100-05-0041	1
7	TERM	1391-8-1	USECO	2100-05-0057	8
Y1	CRYSTAL, 4MHZ	180-502	WVTK	2300-99-0004	1
F1	FUSE, 1 1/2A, 250V	31201.5	LITFU	2400-05-0019	1
8	FUSE HOLDER, CLIP	102071	LITFU	2400-05-0031	2
9	BRACKET	370	ZRICK	2800-09-0029	1

WAVETEK PARTS LIST | TITLE: PCA, GPIB/MICRO-PROC | ASSEMBLY NO: 1100-00-1129 PAGE 2 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
18	WASHER	851547F015	MOT	2800-11-0015	3
13	RIVET 1/8X3/16L	1125-0406	AVDEL	2800-12-0011	1
21	NUT, HEX, CAD I 6-32 R/P X	6-32 R/P HEX NUT	CMRCL	2800-16-6100	2
12	SCREW, SELF TAPPING TYPE B, PAN CROSS RECESS, 4-40X1/4	4-24 X 1/4	CMRCL	2800-22-4142	2
16	SCREW, SELF LOCKING, PAN CROSS RECESS 4-40X1/4	4-40 X 1/4	CMRCL	2800-23-4104	3
14	6-32 X 1/4 PAN MACH SCR PLPS PLATED NYLOK PELLET	6-32 X 1/4	CMRCL	2800-23-6104	2
17	WASHER, FLAT, 4(.209 O.D.)	NAS620-4	CMRCL	2800-26-4001	4
22	SCREW, PAN, CAD I, CROSS RECESS, 4-40 X 1/2	MS51957-17	COML	2800-38-4108	1
23	WASHER, SPLIT LOCK, #4	#4SRLW	CMRCL	2800-42-4000	1
20	WASHER, SPLIT LOCK, #6	#6SRLW	CMRCL	2800-42-6000	2
10	JUMPER	461-2871-01-03-10	CAMB	3000-00-0034	3

WAVETEK PARTS LIST | TITLE: PCA, GPIB/MICRO-PROC | ASSEMBLY NO: 1100-00-1129 PAGE 3 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
E1 E2 E3 E4 E5 E6 E7 E8	PINS, JUMPER	430-3704-01-03	CAMB	3000-00-0035	8
11	BATTERY HOLDER	3000-00-0090	WVTK	3000-00-0090	1
15	INSULATOR, MICA	64-21-023-105	ASHVL	3100-00-0006	3
BT1	BATTERY, LITHIUM, 3V	BR-1/2A	PANAS	4000-02-0007	1
K1	RELAY, HIGH POWER 250V, 5A	NC2D-JP-12V	AROMT	4500-00-0022	1
R13 R14	RES, MF, 1/8W, 1%, 100	RN55D-1000F	TRW	4701-03-1000	2
R1 R26 R27 R29 R31 R32 R4	RES, MF, 1/8W, 1%, 100K	RN55D-1003F	TRW	4701-03-1003	7
R10 R11	RES, MF, 1/8W, 1%, 1.1K	RN55D-1101F	TRW	4701-03-1101	2
R21 R22	RES, MF, 1/8W, 1%, 1.21K	RN55D-1211F	TRW	4701-03-1211	2
R12 R2	RES, MF, 1/8W, 1%, 12.4K	RN55D-1242F	TRW	4701-03-1242	2
R19 R20	RES, MF, 1/8W, 1%, 140	RN55D-1400F	TRW	4701-03-1400	2
R17	RES, MF, 1/8W, 1%, 163	RN55D-1630F	TRW	4701-03-1630	1
R28 R30	RES, MF, 1/8W, 1%, 23.7K	RN55D-2372F	TRW	4701-03-2372	2
R15 R23 R25 R6 R7 R8	RES, MF, 1/8W, 1%, 2.49K	RN55D-2491F	TRW	4701-03-2491	7
R16 R18 R5	RES, MF, 1/8, 1%, 499	RN55D-4990F	TRW	4701-03-4990	3

WAVETEK PARTS LIST | TITLE: PCA, GPIB/MICRO-PROC | ASSEMBLY NO: 1100-00-1129 PAGE 4 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R24	RES, MF, 1/8W, 1%, 49.9K	RN55D-4992F	TRW	4701-03-4992	1
RN1 RN2 RN3 RN5 RN6	RES MODULE, 10H	4310R-101-103	BOURN	4770-00-0008	5
RN4	RES MODULE	4310R-101-102	BOURN	4770-00-0022	1
R33	RES, MF, 1/4W, 1%, 10M	CC1005F	AB	4799-00-0056	1
CR1 CR2 CR3 CR6	DIODE	1N5282	FAIR	4801-01-5282	4
CR10 CR11 CR16 CR18	DIODE	1N4002	FAIR	4801-02-0001	4
CR12 CR13 CR14 CR15	DIODE	MR751	MOT	4801-02-0751	4
CR7	DIODE	MBR 120	MOT	4806-02-0120	1
CR3 CR4 CR8	DIODE	5082-2811	HP	4809-02-2811	3
CR17	LED	TIL-220	TI	4899-00-0006	1
CR9	BRIDGE ASSY, 4 AMP	[illegible]	MOT	4899-00-0037	1
SW1	SWITCH, DIP PIANO LEVER	76PB8D8	GRAHL	5199-00-0005	1
VR1 VR2 VR3	IC	LM317T	NSC	7000-03-1700	3
U17	IC	MLM339P	MOT	7000-03-3900	1
U18	IC, DIGITAL 14 BIT COUNTER	CD4060BC	RCA	8000-40-6000	1
U13	IC	MM6116LP-4	HTACH	8000-61-1600	1

WAVETEK PARTS LIST | TITLE: PCA, GPIB/MICRO-PROC | ASSEMBLY NO: 1100-00-1129 PAGE 5 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
U2	IC	MC6803L	MOT	8000-68-0300	1
U1	IC	74LS00	TI	8000-74-0010	1
U5	IC	[illegible]	MOT	8006-84-8800	1
U4	IC	74LS244	TI	8007-42-4410	1
U10 U14 U8	IC	74LS273	TI	8007-42-7310	3
U3 U9	IC	74LS373	MOT	8007-43-7310	2
U6	IC	75160	TI	8007-51-6000	1
U7	IC	SN75161N	TI	8007-51-6100	1
U16	IC, PROGRAMMED REF 8008-21-0200	8600-00-0259	WVTK	8600-00-0259	1
U12	IC, PROGRAMMED REF 8000-27-3200	8600-00-0268	WVTK	8600-00-0268	1

WAVETEK PARTS LIST | TITLE: PCA, GPIB/MICRO-PROC | ASSEMBLY NO: 1100-00-1129 PAGE 6 | REV B

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: PARTS LIST PCA, GPIB/MICRO-PROC
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1 XX ±.030		MODEL NO: 601
	DO NOT SCALE DWG		DWG NO: 1100-00-1129 REV B
	SCALE		CODE IDENT 23338 SHEET 1 OF 1

B-SHOP GRAPHICS/ACCUPRESS REORDER NO. A-3864

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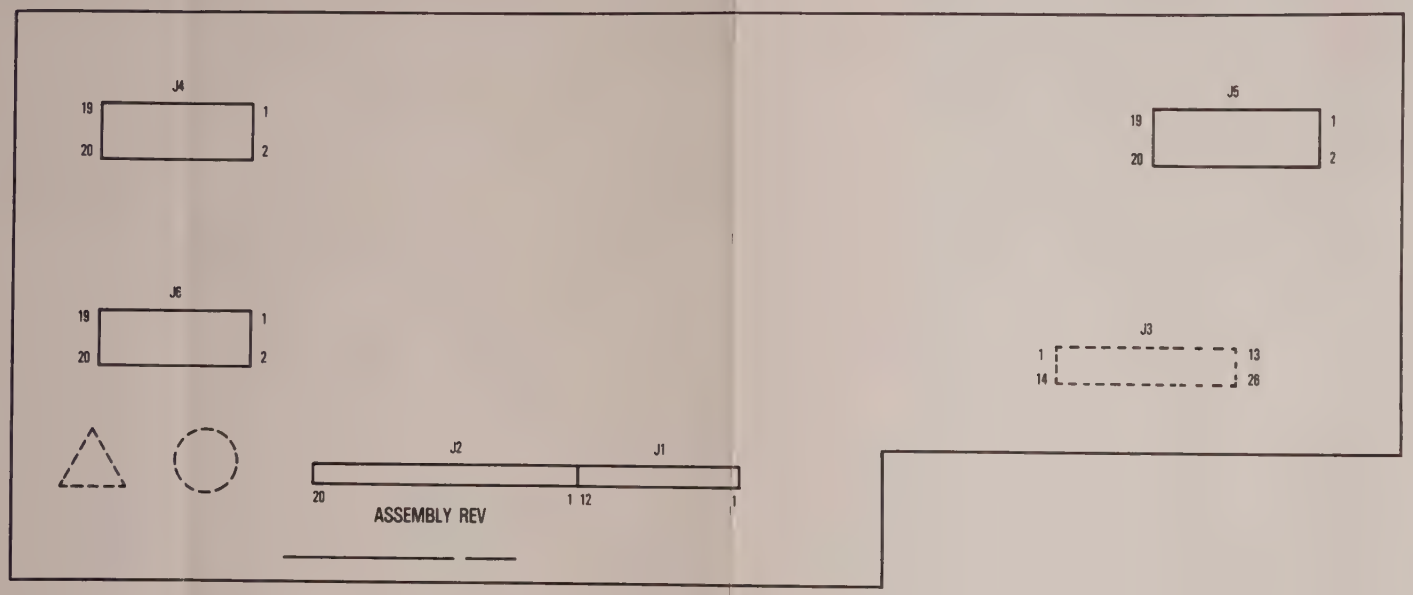

WAVETEK SAN DIEGO, CALIFORNIA

TITLE

MOTHER BOARD

MODEL NO	DWG NO	REV
601	1100-00-1137	
CODE IDENT 23338	SHEET OF	

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REV	ECN	BY	DATE	APP

J1 MICROPROC

1	+5V
2	+5VR
3	+12VB
4	+12VA
5	
6	+12VR
7	PWR ON
8	PORT 13
9	M2 READ
10	M1 READ
11	MØ READ
12	PORT 22

J2 MICROPROC

1	BS1
2	KBD STB
3	RLY RST/
4	KBD CLK
5	RLY CLK
6	DSP CLK
7	RLY STB
8	BSØ
9	DATA Ø
10	DATA 1
11	DATA 2
12	DATA 3
13	DATA 7
14	DATA 6
15	DATA 5
16	DATA 4
17	PORT 11
18	PORT 10
19	PORT 16
20	CHS GND

J3 CONTROL PANEL

1	BS1
2	PORT 13
3	KBD STB
4	DSP CLK
5	DATA Ø
6	DATA 2
7	+5V
8	DATA 7
9	DATA 5
10	PORT 11
11	CHS. GND.
12	N.C.
13	+5V
14	PORT 22
15	PWR ON
16	KBD CLK
17	BSØ
18	DATA 1
19	+5VR
20	DATA 3
21	DATA 6
22	DATA 4
23	PORT 16
24	CHS. GND.
25	+5VR

J6 MODULE 3

1	+5VR
2	+5V
3	
4	
5	RLY CLK
6	M2 READ
7	DATA 2
8	PORT 10 (RLY READ)
9	RLY RST/
10	RLY STB
11	N/C
12	N/C
13	
14	
15	
16	
17	
18	
19	
20	+12VR
	+12VA

J5 MODULE 2

1	+5VR
2	+5V
3	
4	
5	RLY CLK
6	M1 READ
7	DATA 1
8	PORT 10 (RLY READ)
9	RLY RST/
10	RLY STB
11	N/C
12	N/C
13	
14	
15	
16	
17	
18	
19	
20	+12VR
	+12VA

J4 MODULE 1

1	+5VR
2	+5V
3	
4	
5	RLY CLK
6	MØ READ
7	DATA Ø
8	PORT 10 (RLY READ)
9	RLY RST/
10	RLY STB
11	N/C
12	N/C
13	
14	
15	
16	
17	
18	
19	
20	+12VB
	+12VR

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN R.WALKER	DATE 5-31-83	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PRO. ENGR		TITLE SCHEMATIC MOTHERBOARD
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1 XX ±.030		
	DO NOT SCALE DWG		MODEL NO 601 / DWG NO 0103-00-1137 / REV A
	SCALE		CODE IDENT 23338 / SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO A-3884

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG, MOTHER BD	0101-00-1137	WVTK	0101-00-1137	1
NONE	SCHEMATIC, MOTHER BD	0103-00-1137	WVTK	0103-00-1137	1
1	MOTHER BOARD	1700-00-1137	WVTK	1700-00-1137	1
J4 J5 J6	CONN, CARD EDGE, 20PIN	RCV10-4242-0	KELAM	2100-03-0070	3
J2	ASSY, RIBBON CABLE	6002-00-0022	WVTK	6002-00-0022	1
J1	ASSY, RIBBON CABLE	6002-00-0023	WVTK	6002-00-0023	1
J3	ASSY, RIBBON CABLE	6002-00-0025	WVTK	6002-00-0025	1

WAVETEK PARTS LIST

TITLE
PCA, MOTHER BOARD

ASSEMBLY NO.
1100-00-1137

PAGE: 1

REV
A

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES

MATERIAL

FINISH
WAVETEK PROCESS

DRAWN

DATE

PROJ ENGR

RELEASE APPROV

TOLERANCE UNLESS OTHERWISE SPECIFIED
XXX ± .010 ANGLES ±1
XX ± .030

DO NOT SCALE DWG

SCALE

WAVETEK SAN DIEGO, CALIFORNIA

TITLE
PARTS LIST
PCA, MOTHER BOARD

MODEL NO
601

DWG NO
1100-00-1137

REV
A

CODE IDENT
23338

SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A-3884

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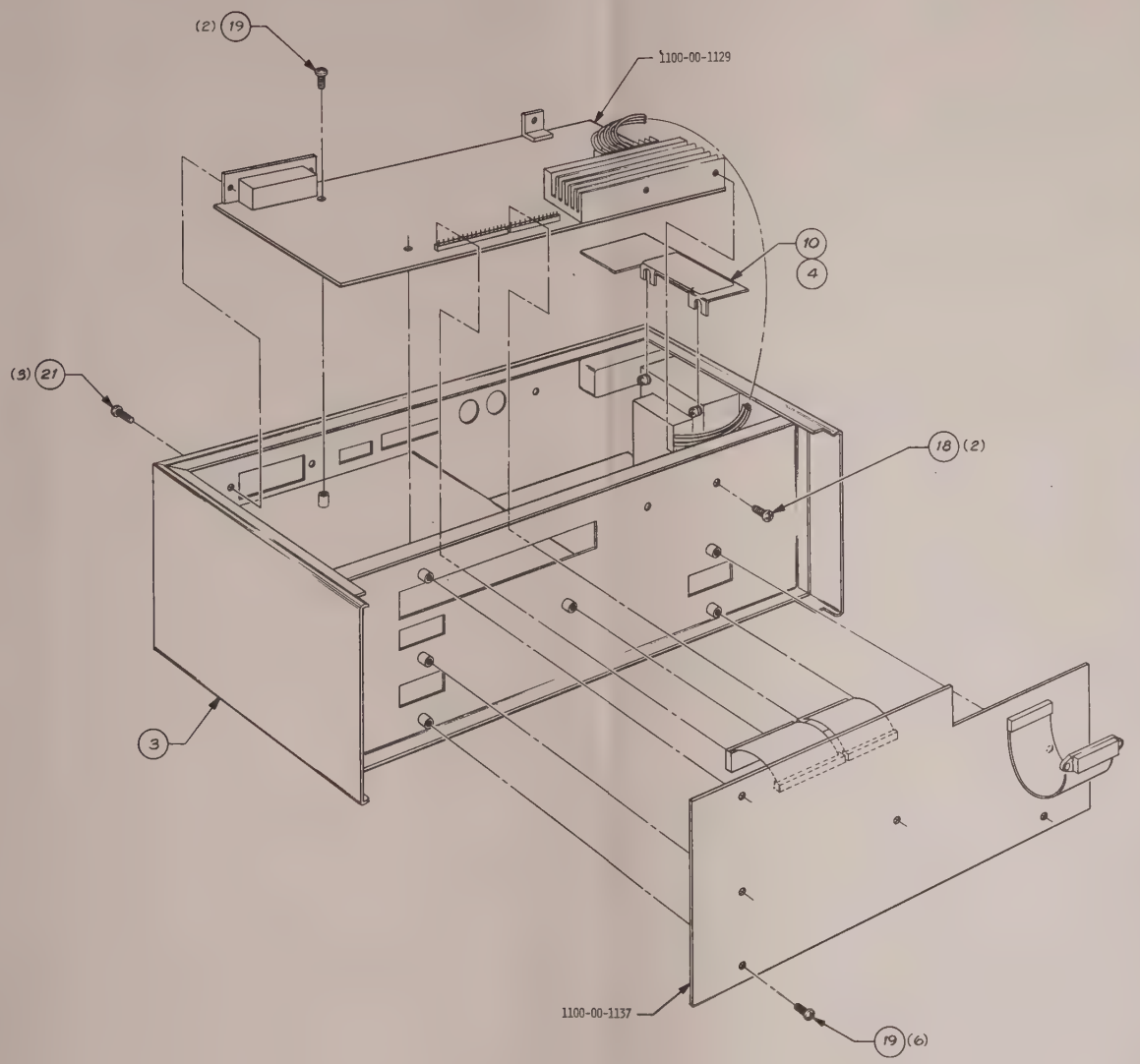
REV	ECN	BY	DATE	APP



NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN CHERMACK 9/26/83	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJ ENGR 11/3/83	TITLE ASSEMBLY, CHASSIS	
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1° XX ± .030		
	DO NOT SCALE DWG	MODEL NO 601	DWG NO 0102-00-1145 REV A
	SCALE NONE	CODE IDENT 23338	SHEET 1 OF 2

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-3854

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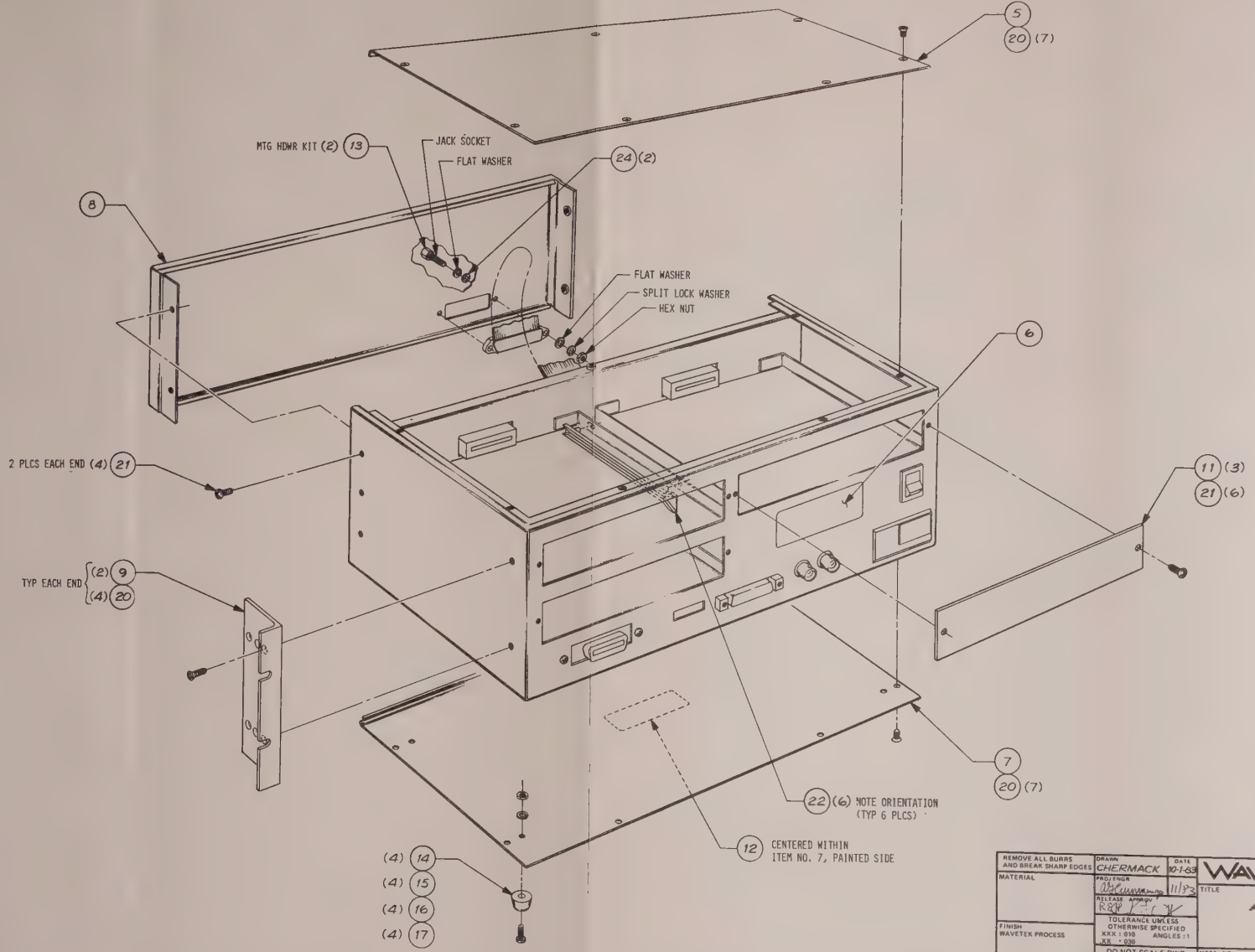
REV	ECN	BY	DATE	APP



NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN CHERMACK	DATE 10-1-69	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE ASSEMBLY, CHASSIS
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1 XX ± .030		
	DO NOT SCALE DWG		MODEL NO 601 / DWG NO 0102-00-1145 / REV A
	SCALE NONE		DRWG IDENT 23338 / SHEET 2 OF 2

BISHOP GRAPHICS/ACCUPRESS RECORDER NO. A-3864

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	DRIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DWG, CHASSIS	0102-00-1145	WVTK	0102-00-1145	1
3	ASSY, CHASSIS SUB	601-1200	WVTK	1206-00-1200	1
4	LABEL, CAUTION	1400-01-1400	WVTK	1400-01-1400	1
6	SERIAL TAG MODEL 601	1400-01-6920	WVTK	1400-01-6920	1
8	PANEL, FRONT	1400-01-6970	WVTK	1400-01-6970	1
9	RACK EAR (DARK GREY)	1400-01-7112	WVTK	1400-01-7112	2
10	SHIELD, CORCOM	1400-01-7123	WVTK	1400-01-7123	1
11	BLANK, MODULE COVER PLATE	1400-01-7130	WVTK	1400-01-7130	3
12	LABEL, FCC COMPLIANCE	1400-01-7160	WVTK	1400-01-7160	1
5	COVER, TOP	1400-01-7622	WVTK	1400-01-7622	1
7	COVER, MODIFIED FROM 1400-01-7622	1400-01-7639	WVTK	1400-01-7639	1
22	CARD GUIDE NATURAL	2100-06-0018	WVTK	2100-06-0018	6
13	JACK SOCKET	207719-1	AMP	2100-07-0021	2
14	FOOT, RUBBER	2197W	ROYAL	2800-08-0013	4
17	SCREW, HEX NUT, CAD PLATE 6-32	MS35649-264	COML	2800-14-6100	4

WAVETEK PARTS LIST | TITLE ASSY, CHASSIS | ASSEMBLY NO 1101-00-1145 PAGE 1 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	DRIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
18	SCREW, SELF LOCKING, PAN CROSS RECESS 4-40X1/4	4-40 X 1/4	CMRCL	2800-23-4104	2
19	6-32 X 1/4 PAN MACH SCR PLPS PLATED NYLOK PELLET	6-32 X 1/4	CMRCL	2800-23-6104	8
24	LOCKWASHER, #4 INT TOOTH	#4ITLW	CMRCL	2800-24-4000	2
15	SCREW, PAN, CAD PLATE, 6-32X1/2	6-32 X 1/2	CMRCL	2800-38-6108	4
21	SCREW, 6-32X3/8 PH MS PHLPS, BLK	2800-40-6106	WVTK	2800-40-6106	12
16	WASHER, SPLIT LOCK, E	#6SRLW	CMRCL	2800-42-6000	4
20	SCREW, 6-32X3/8 FH MS 100DEG. PHLPS BLK	2800-43-6106	WVTK	2800-43-6106	18

WAVETEK PARTS LIST | TITLE ASSY CHASSIS | ASSEMBLY NO 1101-00-1145 PAGE 2 | REV B

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES | MATERIAL | FINISH WAVETEK PROCESS | DRAWN | DATE | PROJ ENGR | RELEASE APPROV | TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1 XX ± .030 | DO NOT SCALE DWG | SCALE

WAVETEK SAN DIEGO, CALIFORNIA

TITLE: PARTS LIST ASSY, CHASSIS

MODEL NO	DWG NO	REV
601	1101-00-1145	B

CODE IDENT 23338 | SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS RECORDER NO. A-3384

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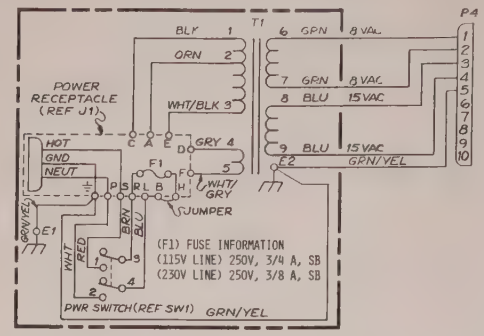
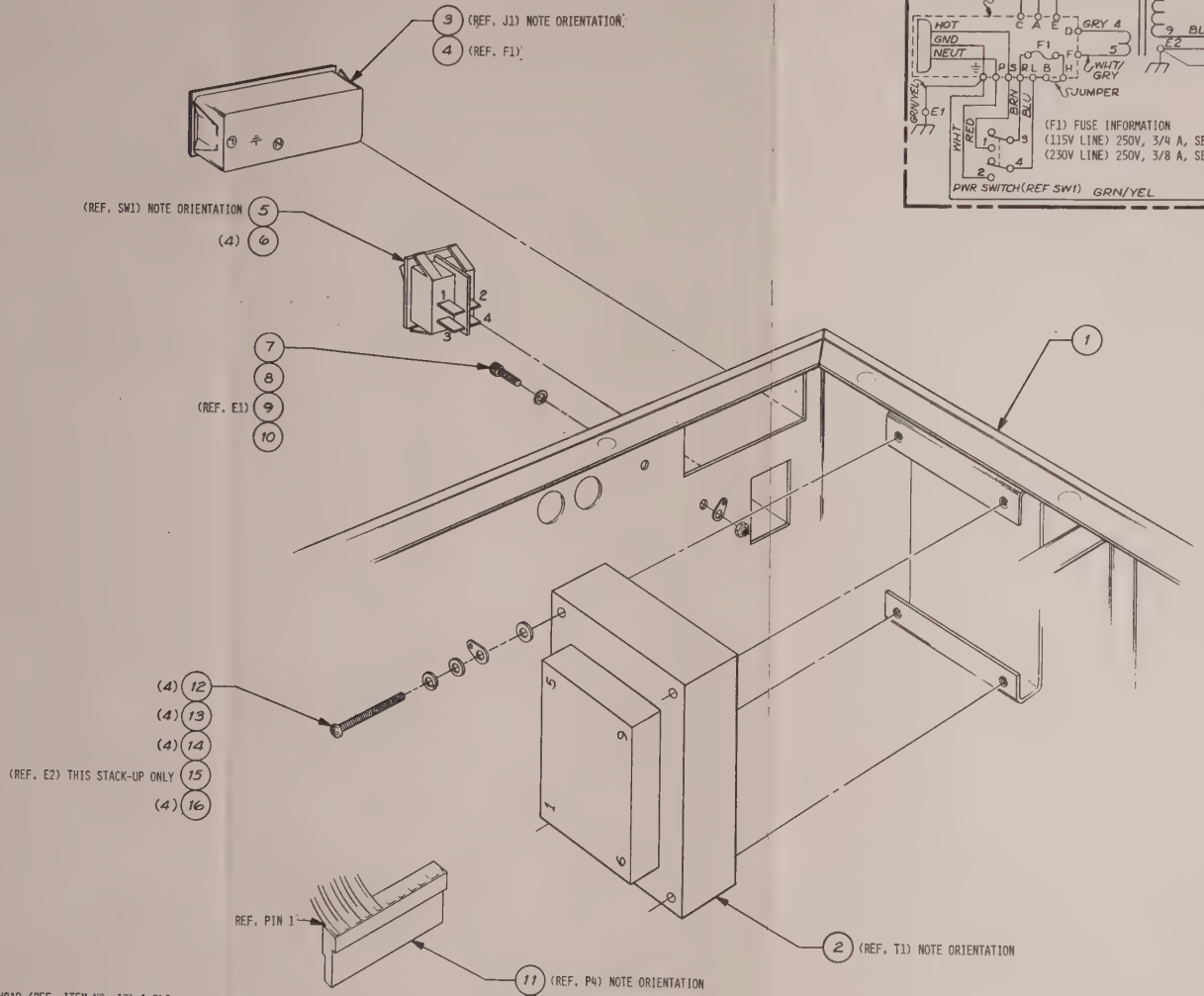
REV	ECN	BY	DATE	APP





LOCATE AS REQUIRED (17) (3)

WIRE LIST				
			DESTINATION	
AWG	COLOR	LENGTH	FROM	TO
20	GRN	4"	P4-1	T1-6
20	GRN	4"	P4-2	T1-7
20	BLU	4"	P4-3	T1-8
20	BLU	4"	P4-4	T1-9
20	GRN/YEL	4 1/4"	P4-5	T1-E2
			P4-6	
			P4-7	
			P4-8	
			P4-9	
			P4-10	
			POWER RECEPTACLE PIN (J1)	
24	BLK	4 3/4"	J1-C	T1-1
24	ORN	4 3/4"	J1-A	T1-2
24	WHT/BLK	4 3/4"	J1-E	T1-3
24	GRY	4 3/4"	J1-D	T1-4
24	WHT/GRY	4 3/4"	J1-F	T1-5
22	GRN/YEL	2 1/4"	J1-⏚	E1
22	BUS	2 1/4"	J1-B	J1-B
22	BRN	6"	J1-R	SW1-3
22	RED	6"	J1-S	SW1-1
22	BLU	6"	J1-L	SW1-4
22	WHT	6"	J1-P	SW1-2
22	GRN/YEL	3"	J1-⏚	T1-E2

(1) (2) (3) SLEEVE WIRES AS REQUIRED, WITH TY-WRAP (REF. ITEM NO. 17) 1 PLC.
(2) (2) SLEEVE WIRES AS REQUIRED.
(1) (1) TY-WRAP (REF. ITEM NO. 17) 3 PLCS, AS REQUIRED.

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN CHERMACK	DATE 9/28/83	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: SUB ASSEMBLY, CHASSIS
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 XX ± .030 ANGLES ± 1		
	DO NOT SCALE DWG		MODEL NO 601 / DWG NO 1206-00-1200 / REV A
	SCALE NONE		CODE IDENT 23338 / SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-5894

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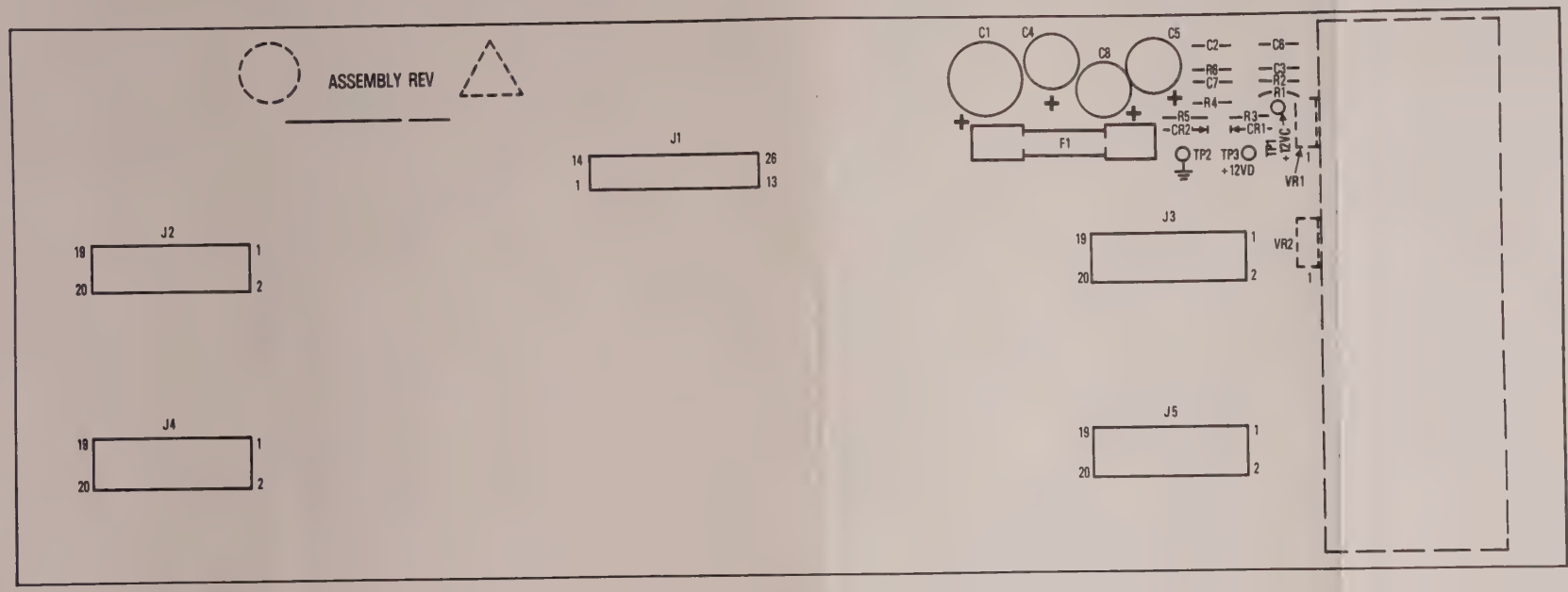

WAVETEK SAN DIEGO, CALIFORNIA

TITLE: MOTHER BOARD		
MODEL NO: 602	DWG NO: 1100-00-1138	REV
CODE IDENT: 23338	SHEET OF	

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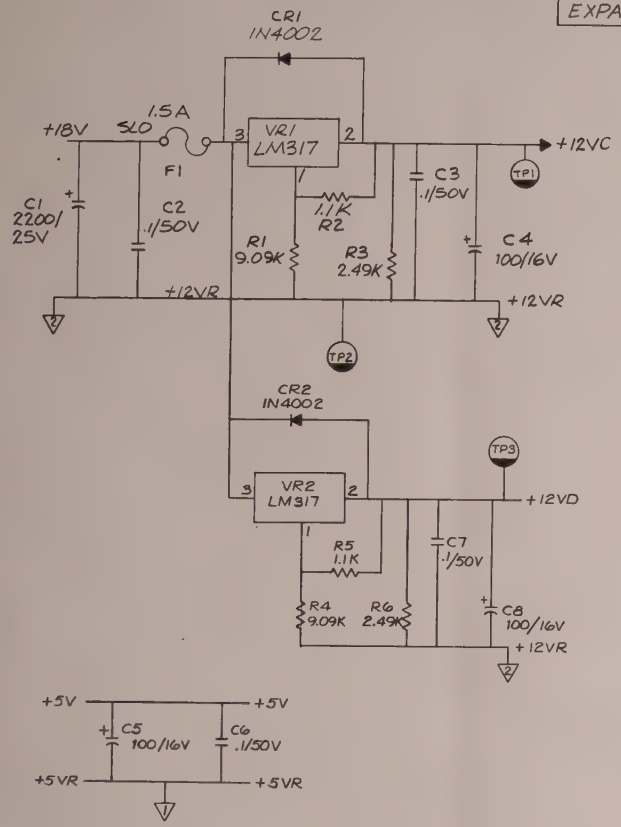
REV	ECN	BY	DATE	APP



J1 — EXPANSION IN

1	N.C.
2	PORT 10
3	+5 V
4	M3 READ
5	M5 READ
6	DATA 4
7	DATA 6
8	RLY STB
9	RLY RST/
10	+12 VR
11	+12 VR
12	+18 V
13	+18 V
14, 15	CHS GND
16	M6 READ
17	M4 READ
18	DATA 5
19	DATA 3
20	RLY CLK
21	+5 VR
22	+12 VR
23	+12 VR
24	+18 V
25	+18 V
26	N.C.

J2 — MODULE 4

1	+5VR
2	+5V
3	
4	
5	RLY CLK
6	M3 READ
7	DATA 3
8	PORT 10
9	RLY RST/
10	RLY STB
11	N.C.
12	N.C.
13	
14	
15	
16	
17	
18	
19	+12VC
20	+12VR

J3 — MODULE 5

1	+5VR
2	+5V
3	
4	
5	RLY CLK
6	M4 READ
7	DATA 4
8	PORT 10
9	RLY RST/
10	RLY STB
11	N.C.
12	N.C.
13	
14	
15	
16	
17	
18	
19	+12VC
20	+12VR

J4 — MODULE 6

1	+5VR
2	+5V
3	
4	
5	RLY CLK
6	M5 READ
7	DATA 5
8	PORT 10
9	RLY RST/
10	RLY STB
11	N.C.
12	N.C.
13	
14	
15	
16	
17	
18	
19	+12VD
20	+12VR

J5 — MODULE 7

1	+5VR
2	+5V
3	
4	
5	RLY CLK
6	M6 READ
7	DATA 6
8	PORT 10
9	RLY RST/
10	RLY STB
11	N.C.
12	N.C.
13	
14	
15	
16	
17	
18	
19	+12VD
20	+12VR

2. ALL CAPACITORS ARE IN MICROFARADS.
1. ALL RESISTORS ARE 1/8 W, AND ARE IN OHMS.

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN R WALKER	DATE 5-31-83	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE SCHEMATIC, MOTHERBOARD, EXPANSION CHASSIS BOARD
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1 XX ± .030		MODEL NO 602
	DO NOT SCALE DWG		DWG NO 0103-00-1138 REV A
	SCALE		CODE IDENT 23338 SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-3884

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG. MOTHER BD EXPANSION CHASSIS	0101-00-1138	WVTK	0101-00-1138	1
NONE	SCHEMATIC, MOTHER BD EXPANSION CHASSIS	0103-00-1138	WVTK	0103-00-1138	1
1	HEATSINK	1400-01-7173	WVTK	1400-01-7173	1
C2 C3 C6 C7	CAP. CER. MON., 1MF. 30V	CAC03Z5U104Z030A	CORNO	1500-01-0405	4
C4 C5 C8	CAP. ELECT. 100MF. 25V RADIAL LEAD. SP .20	CRE SERIES 100/25	CAPAR	1500-31-0102	3
C1	CAP. ELECT, 2200MF, 25V RADIAL LEAD	CRE SERIES 2200/25	CAPAR	1500-32-2202	1
2	MOTHER BD EXPANSION CHASSIS	1700-00-1138	WVTK	1700-00-1138	1
J2 J3 J4 J5	CONN. CARD EDGE. 20PIN	RCV10-4242-0	KELAM	2100-03-0070	4
TP1 TP2 TP3	BUSS BAR STANDOFF	2110-001	ARTWR	2100-05-0024	3
F1	FUSE, 1 1/2A. 250V	31201.5	LITFU	2400-05-0019	1
3	FUSE HOLDER, CLIP	102071	LITFU	2400-05-0031	2
8	WASHER	951547F015	MOT	2800-11-0015	2
6	SCREW, SELF LOCKING, PAN CROSS RECESS 4-40X1/4	4-40 X 1/4	CMRCL	2800-23-4104	2
4	6-32 X 1/4 PAN MACH	6-32 X 1/4	CMRCL	2800-23-6104	2

WAVETEK PARTS LIST | TITLE: PCA, MOTHER BOARD EXPANSION CHASSIS | ASSEMBLY NO: 1100-00-1138 | PAGE 1 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
	SCR PLPS PLATED NYLOK PELLET				
7	WASHER, FLAT, 4(.209 O.D.)	NAS620-4	CMRCL	2800-26-4001	2
5	INSULATOR, MICA	64-21-023-106	ASHVL	3100-00-0006	2
R2 R5	RES, MF, 1/8W, 1%, 1.1K	RN55D-1101F	TRW	4701-03-1101	2
R3 R6	RES, MF, 1/8W, 1%, 2.49K	RN55D-2491F	TRW	4701-03-2491	2
R1 R4	RES, MF, 1/8W, 1%, 9.09K	RN55D-9091F	TRW	4701-03-9091	2
CR1 CR2	DIODE	1N4002	FAIR	4801-02-0001	2
J1	ASSY, RIBBON CABLE	6002-00-0021	WVTK	6002-00-0021	1
VR1 VR2	IC	LM317T	NSC	7000-03-1700	2

WAVETEK PARTS LIST | TITLE: PCA, MOTHER BOARD EXPANSION CHASSIS | ASSEMBLY NO: 1100-00-1138 | PAGE 2 | REV B

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: PARTS LIST PCA, MOTHER BOARD EXPANSION CHASSIS
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1 XX ±.030		MODEL NO: 602 / DWG NO: 1100-00-1138 / REV: B
	DO NOT SCALE DWG		CODE IDENT: 23338 / SHEET 1 OF 1
	SCALE		

NOTE UNLESS OTHERWISE SPECIFIED

BISHOP GRAPHICS/ACCUPRESS RECORDER NO. A-3089

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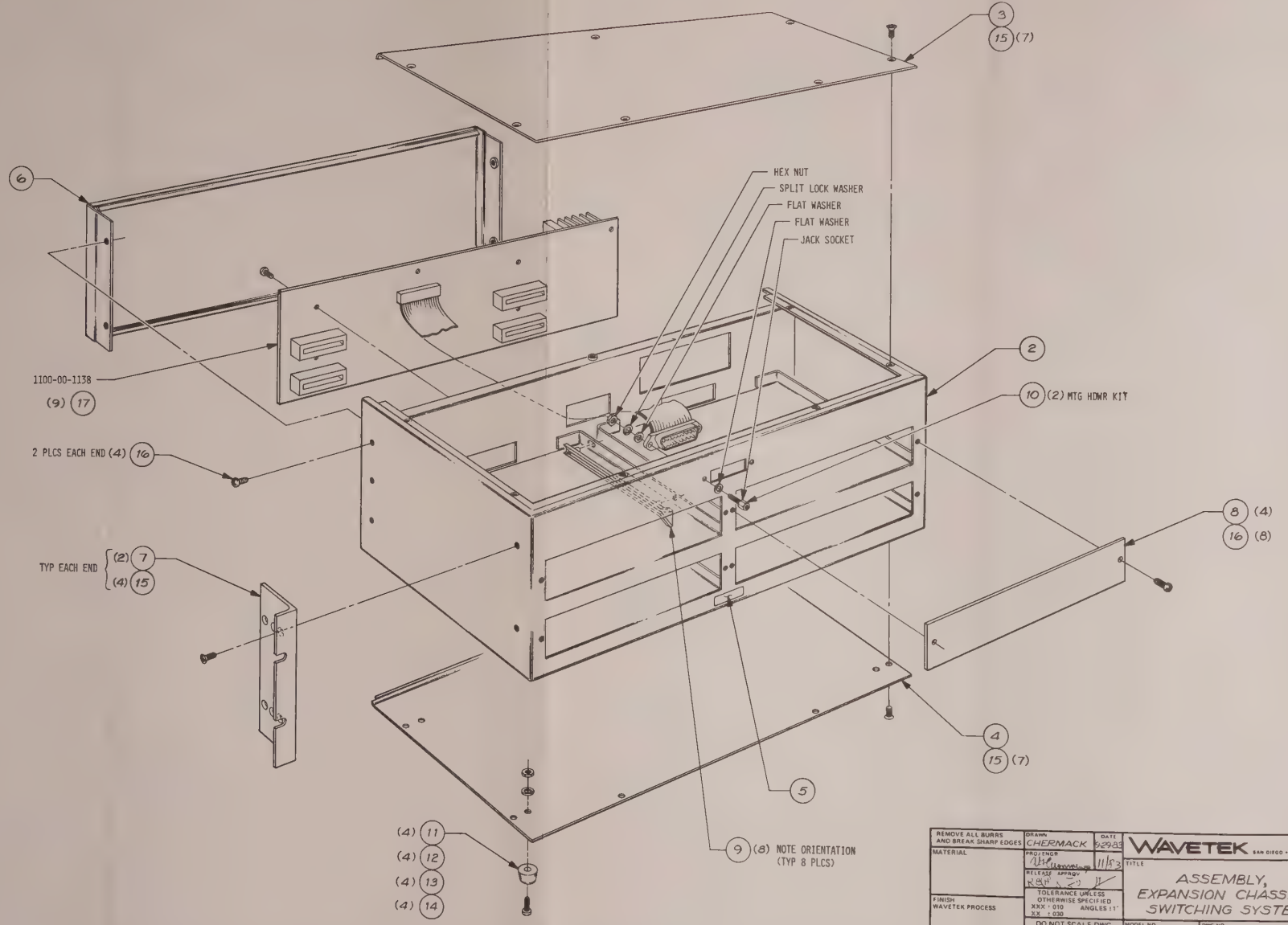
REV	ECN	BY	DATE	APP



NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN CHERMACK	DATE 6/29/93	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: ASSEMBLY, EXPANSION CHASSIS SWITCHING SYSTEM
	RELEASE APPROV	11/9/93	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		
	DO NOT SCALE DWG		MODEL NO 602 · DWG NO 0102-00-1140 · REV A
	SCALE NONE		CODE IDENT 23338 · SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-3894

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG. EXPANSION CHASSIS	0102-00-1140	WVTK	0102-00-1140	1
2	ASSY, CHASSIS EXPANSION	602-1220	WVTK	1201-00-1220	1
5	SERIAL TAG MODEL 602	1400-01-6950	WVTK	1400-01-6950	1
6	PANEL, FRONT	1400-01-6962	WVTK	1400-01-6962	1
7	RACK EAR (DARK GREY)	1400-01-7112	WVTK	1400-01-7112	2
8	BLANK, MODULE COVER PLATE	1400-01-7130	WVTK	1400-01-7130	4
3	COVER, TOP	1400-01-7622	WVTK	1400-01-7622	1
4	COVER, MODIFIED FROM 1400-01-7622	1400-01-7639	WVTK	1400-01-7639	1
9	CARD GUIDE NATURAL	2100-06-0018	WVTK	2100-06-0018	8
10	JACK SOCKET	207719-1	AMP	2100-07-0021	2
11	FOOT, RUBBER	2197W	ROYAL	2800-08-0013	4
14	SCREW, HEX NUT, CAD PLATE 6-32	MS35649-264	COML	2800-14-6100	4
17	6-32 X 1/4 PAN MACH SCR PLPS PLATED NYLOK PELLET	6-32 X 1/4	CMRCL	2800-23-6104	9

WAVETEK PARTS LIST | TITLE: ASSY. EXPANSION CHASSIS | ASSEMBLY NO. 1101-00-1140 | PAGE 1 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
12	SCREW, PAN, CAD PLATE, 6-32X1/2	6-32 X 1/2	CMRCL	2800-38-6108	4
16	SCREW, 6-32X3/8 PH MS PHLPS. BLK	2800-40-6106	WVTK	2800-40-6106	12
13	WASHER, SPLIT LOCK, #6	#6SRLW	CMRCL	2800-42-6000	4
15	SCREW, 6-32X3/8 FH MS 100DEG. PHLPS BLK	2800-43-6106	WVTK	2800-43-6106	18

WAVETEK PARTS LIST | TITLE: ASSY. EXPANSION CHASSIS | ASSEMBLY NO. 1101-00-1140 | PAGE 2 | REV B

REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS
DRAWN | DATE
PROJ ENGR
RELEASE APPROV
TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1 .XX ±.030
DO NOT SCALE DWG
SCALE

WAVETEK SAN DIEGO, CALIFORNIA

TITLE: PARTS LIST ASSY, EXPANSION CHASSIS

MODEL NO	DWG NO	REV
602	1101-00-1140	B

CODE IDENT 23338 | SHEET 1 OF 1

NOTE UNLESS OTHERWISE SPECIFIED

SHOP GRAPHICS/ACCUPRESS REORDER NO A 3994

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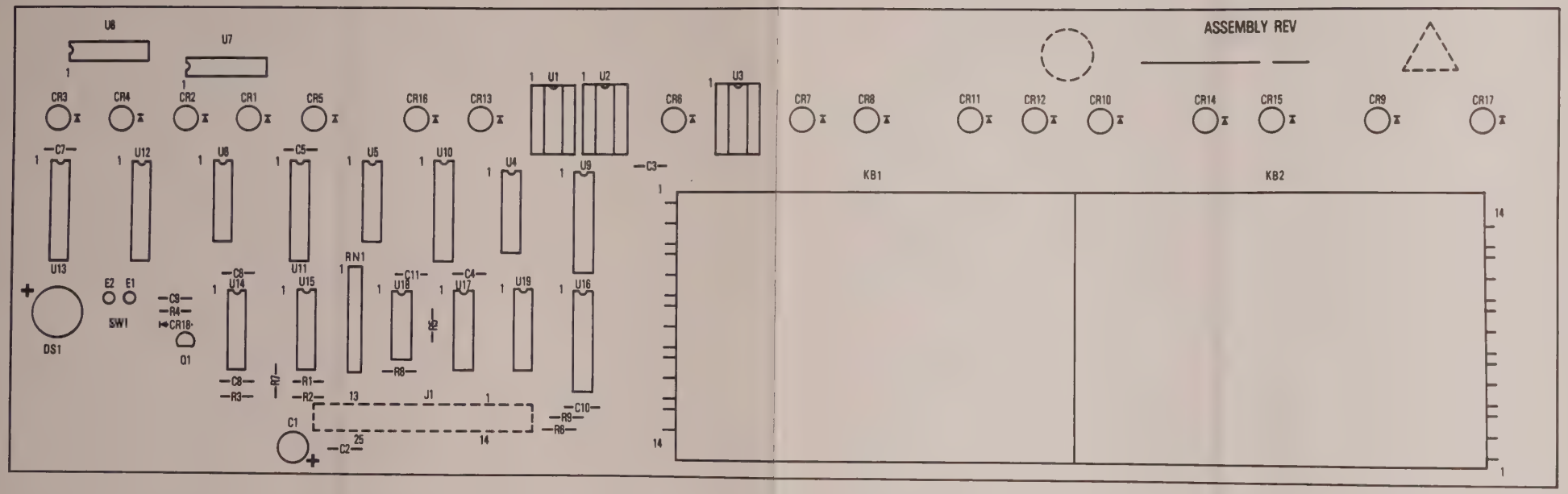

WAVETEK SAN DIEGO • CALIFORNIA		
TITLE: KEYBOARD/DISPLAY		
MODEL NO: 603	DWG NO: 1100-00-1142	REV
CODE IDENT: 23338	SHEET OF	

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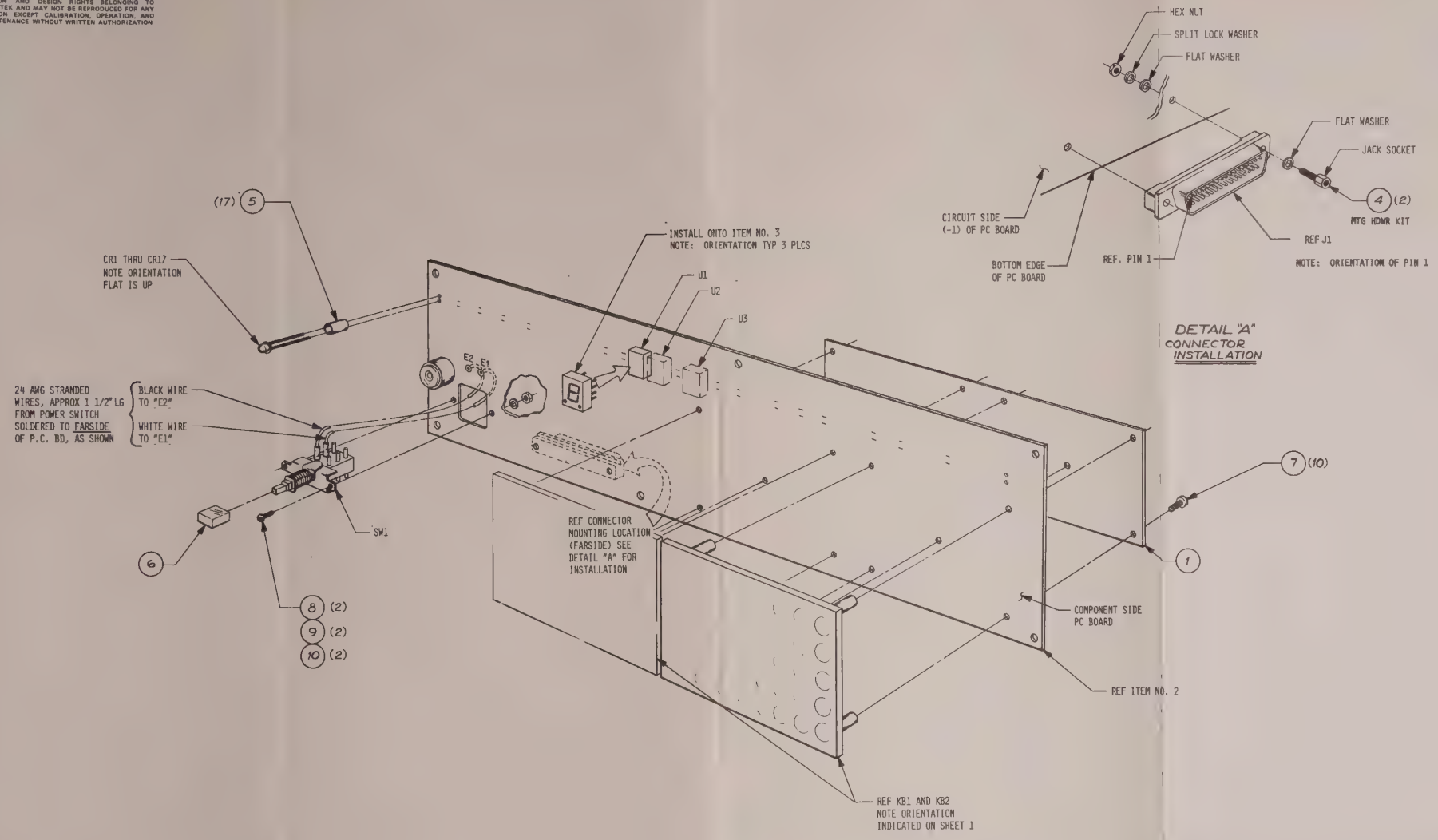
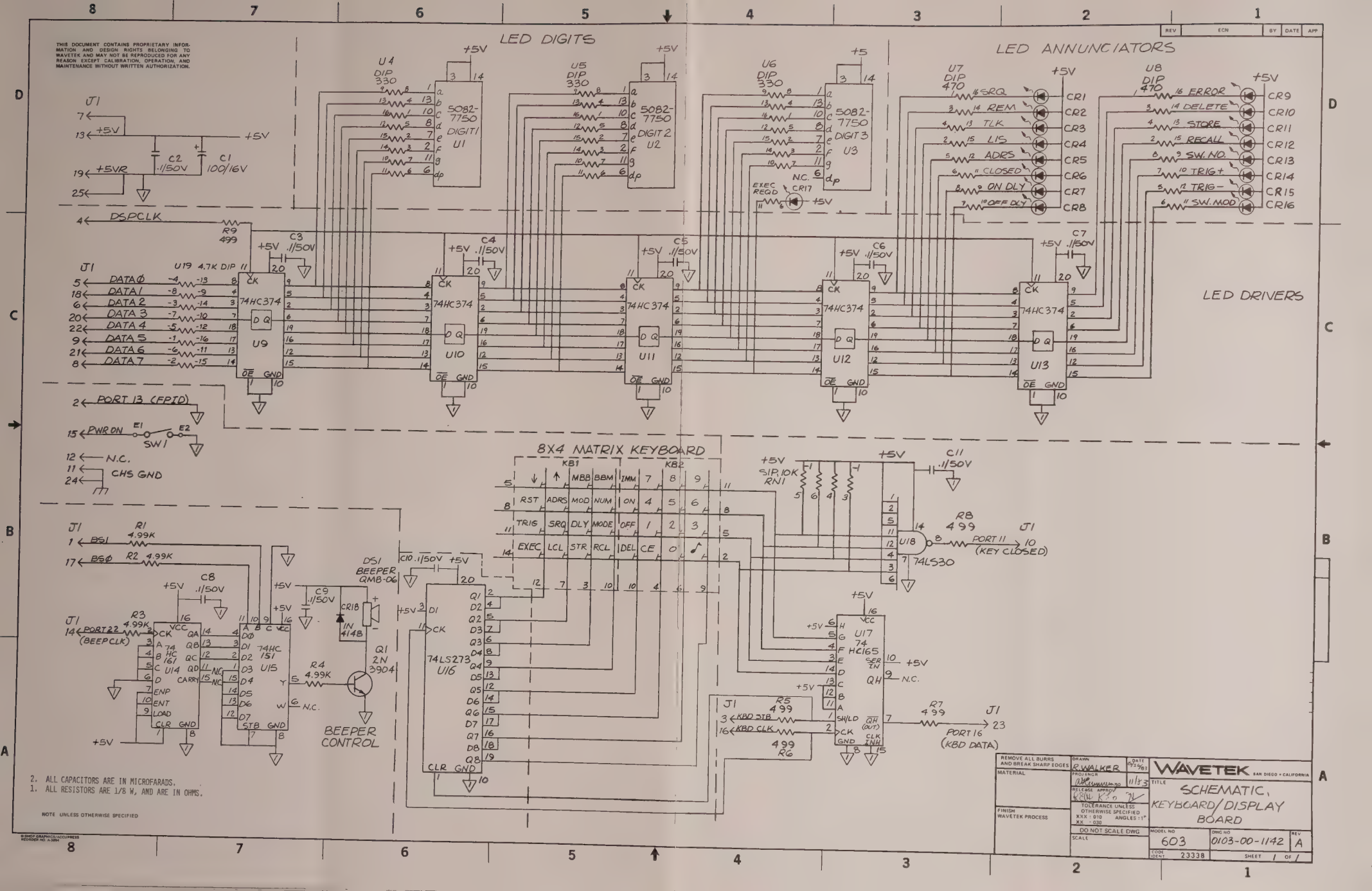
REV	ECN	BY	DATE	APP



NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN CHERMACK	DATE 9-1983	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ MGR		TITLE ASSEMBLY KEYBOARD/DISPLAY BOARD
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1 XX ±.030		
	DO NOT SCALE DWG	MODEL NO 603	DWG NO 0101-00-1142 REV A
	SCALE NONE	CODE IDENT 23338	SHEET 2 OF 2

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-3994


LED DIGITS
LED ANNUNCIATORS
LED DRIVERS
8X4 MATRIX KEYBOARD
BEEPER CONTROL
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REV ECN BY DATE APP
J1
+5V
+5VR
C2 .1/50V
C1 100/16V
U4 DIP 330
U5 DIP 330
U6 DIP 330
5082-7750 DIGIT1 U1
5082-7750 DIGIT 2 U2
5082-7750 DIGIT 3 U3
N.C.
EXEC REQD
CR17
U7 DIP 470
U8 DIP 470
SRQ
REM
TLK
LIS
ADRS
CLOSED
ON DLY
OFF DLY
ERROR
DELETE
STORE
RECALL
SW. NO.
TRIG+
TRIG-
SW. MOD
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
CR11
CR12
CR13
CR14
CR15
CR16
DSPCLK
R9 499
C3 .1/50V
C4 .1/50V
C5 .1/50V
C6 .1/50V
C7 .1/50V
U19 4.7K DIP
DATA0
DATA1
DATA2
DATA3
DATA4
DATA5
DATA6
DATA7
74HC374
U9
U10
U11
U12
U13
OE GND
PORT 13 (FPID)
PWR ON
E1
E2
SW1
N.C.
CHS GND
8X4 MATRIX KEYBOARD
KB1
KB2
MBB BBM IMM 7 8 9
RST ADRS MOD NUM ON 4 5 6
TRIG SRQ DLY MODE OFF 1 2 3
EXEC LCL STR RCL IDEL CE 0
SIP.10K RN1
C11 .1/50V
R8 499
U18
74LS30
PORT 11 (KEY CLOSED)
J1 10
R1 4.99K
R2 4.99K
BS1
BS0
C8 .1/50V
C9 .1/50V
C10 .1/50V
R3 4.99K
PORT 22 (BEEPCLK)
74HC161 U14
74HC151 U15
ENP
ENT
LOAD
CLR GND
STB GND
DS1 BEEPER QMB-06
CR18 IN 4148
R4 4.99K
Q1 2N 3904
74LS273 U16
U17 74HC165
SER IN
SH/LD
CK
CLK INH
QH (OUT)
R5 499
R7 499
KBD STB
KBD CLK
R6 499
PORT 16 (KBD DATA)
J1 23
2. ALL CAPACITORS ARE IN MICROFARADS.
1. ALL RESISTORS ARE 1/8 W, AND ARE IN OHMS.
NOTE UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS
DRAWN R.WALKER
DATE 9/29/93
PROGR
RELEASE APPROV
TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 XX ± .030 ANGLES ± 1°
DO NOT SCALE DWG
SCALE
WAVETEK SAN DIEGO, CALIFORNIA
TITLE SCHEMATIC, KEYBOARD/DISPLAY BOARD
MODEL NO 603
DWG NO 0103-00-1142
REV A
CODE IDENT 23338
SHEET 1 OF 1

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	DRIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG, KEYBOARD DISPLAY	0101-00-1142	WVTK	0101-00-1142	1
NONE	SCHEMATIC, KEYBOARD DISPLAY	0103-00-1142	WVTK	0103-00-1142	1
KB1 KB2	ASSY, KEYBOARD	178/270-0939	WVTK	1206-00-0939	2
1	STIFFENER, BOARD	1400-01-7153	WVTK	1400-01-7153	1
C10 C11 C2 C3 C4 C5 C6 C7 C8 C9	CAP, CER, MON, .1MF, 50V	CAC03Z5U1042050A	CORNG	1300-01-0405	10
C1	CAP, ELECT, 100MF, 25V RADIAL LEAD, SP .20	CRE SERIES 100/25	CAPAR	1300-31-0102	1
2	DISPLAY/KEYBOARD	1700-00-1142	WVTK	1700-00-1142	1
J1	CONNECTOR, 'D' MALE	207089-1	AMP	2100-02-0148	1
3	SOCKET, 14 PIN	C8814-01	TI	2100-03-0032	6
4	JACK SOCKET	207719-1	AMP	2100-07-0021	2
10	SCREW, HEX NUT, CAD PLATE 2-56	2-56 HEX NUT	CMRCL	2900-14-2100	2
7	SCREW, SELF TAPPING TYPE B, PAN CROSS RECESS, 4-40X3/8	4-24 X 3/8	CMRCL	2800-22-4162	10
8	SCREW, PAN, CAD I, CROSS RECESS, 2-56 X 1/4	MS51957-3	COML	2800-38-2104	2

WAVETEK PARTS LIST | TITLE PCA, KEYBOARD/DISPLAY | ASSEMBLY NO. 1100-00-1142 PAGE: 1 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	DRIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
9	LOCKWASHER, #2 SPLIT BIN 325	#2SRLW	CMRCL	2800-42-2000	2
DS1	BEEPER	GM8-06	STMIC	3000-00-0085	1
5	NYLON L.E.D. SPACER	905-300	BIVAR	3000-00-0106	17
R5 R6 R7 R8 R9	RES, MF, 1/8, 1%, 499	RN55D-4990F	TRW	4701-03-4990	5
R1 R2 R3 R4	RES, MF, 1/8W, 1% 4.99K	RN55D-4991F	TRW	4701-03-4991	4
RN1	RES MODULE, 10K	4310R-101-103	BOURN	4770-00-0008	1
U19	RES MODULE, 4.7K	4116R-001-472	BOURN	4770-00-0020	1
U7 U8	RES MODULE, 470	4116R-001-471	BOURN	4770-00-0036	2
U4 U5 U6	RES MODULE, 330 OHM	4116R-001-331	BOURN	4770-00-0037	3
CR18	DIODE	1N4148	FAIR	4807-02-6666	1
CR1 CR10 CR11 CR12 CR13 CR14 CR15 CR16 CR17 CR2 CR3 CR4 CR5 CR6 CR7 CR8 CR9	LED	TIL-220	TI	4899-00-0006	17
U1 U2 U3	DISPLAY, SEVEN SEGMENT	5082-7750	HP	4899-00-0036	3
Q1	TRANS	2N3904	FAIR	4901-03-9040	1
SW1	SWITCH ASSY PB	740-400	WVTK	5102-00-0003	1
6	BUTTON, BONE GRAY	B-303	CRL	5103-04-0009	1

WAVETEK PARTS LIST | TITLE PCA, KEYBOARD/DISPLAY | ASSEMBLY NO. 1100-00-1142 PAGE: 2 | REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	DRIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
U18	IC	74LS30	SIG	8000-74-3010	1
U15	IC,	74HC151	TI	8007-41-5140	1
U14	IC, PROGRAMMABLE COUNTER	74HC161	MOT	8007-41-6140	1
U17	IC, SHIFT REGISTER	74HC165	MOT	8007-41-6540	1
U16	IC	74LS273	TI	8007-42-7310	1
U10 U11 U12 U13 U9	IC, DIGITAL OCTAL LATCH	74HC374	TI	8007-43-7440	5

WAVETEK PARTS LIST | TITLE PCA, KEYBOARD/DISPLAY | ASSEMBLY NO. 1100-00-1142 PAGE: 3 | REV B

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: PARTS LIST PCA, KEYBOARD/DISPLAY
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1 XX ± .030		
	DO NOT SCALE DWG		MODEL NO 603 / DWG NO 1100-00-1142 / REV B
	SCALE		CODE IDENT 23338 / SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-3884

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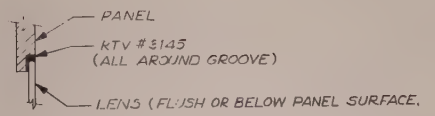
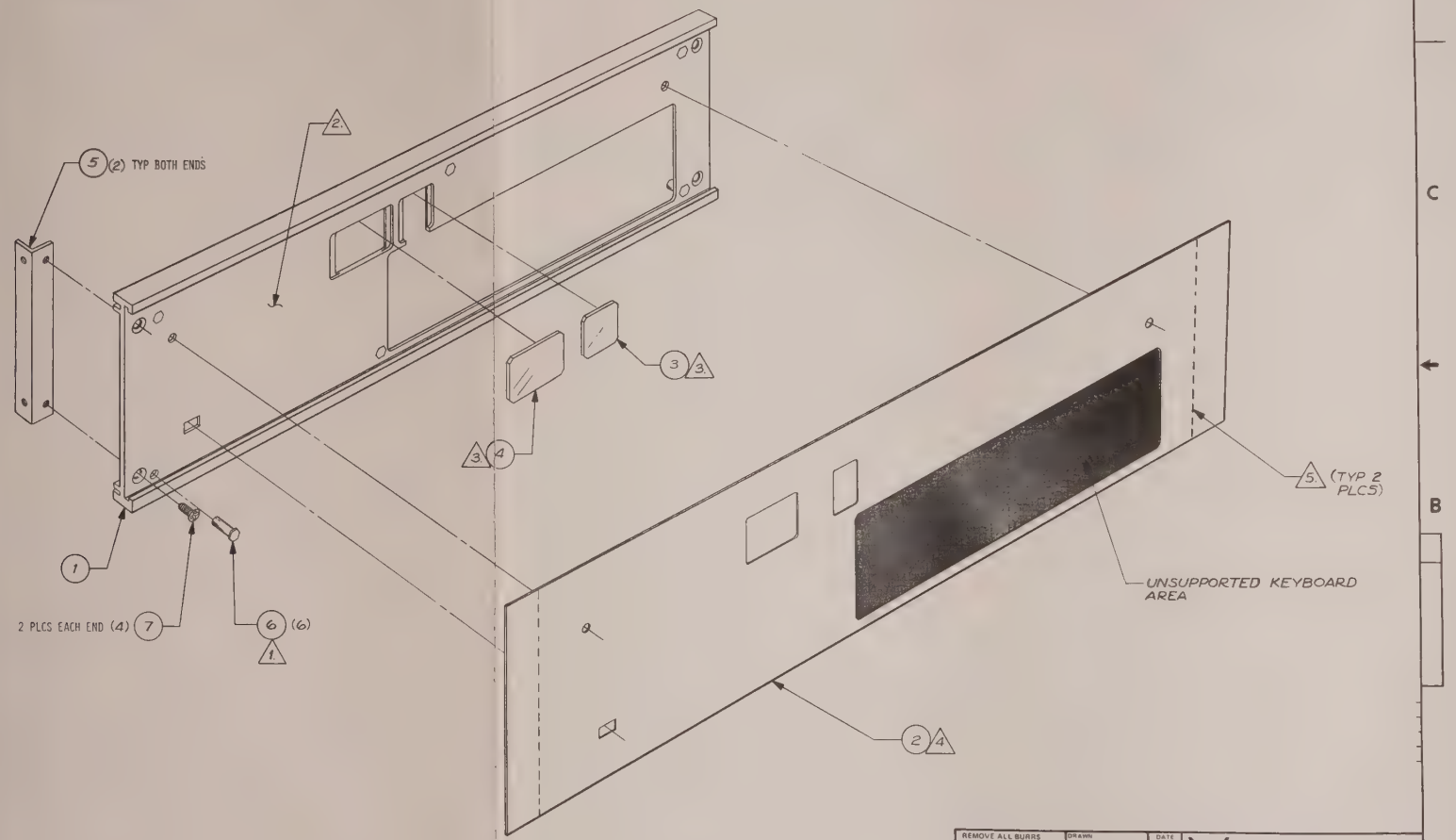
REV	ECN	BY	DATE	APP



DETAIL "A"



5. Trim overlay to panel length scoring back surface of overlay with sharp exacto knife. Use panel edge as knife guide. Bend overlay tab forward to remove.
4. Front panel overlay application
   A. Clean front panel surface with isopropyl alcohol
   B. Lightly spray (fog) entire panel surface with solution of dish soap and water (solution mix of approx. 1/2 tsp dish soap to 1 qt. water)
   C. Remove peel-off backing overlay. Do not touch exposed adhesive; hold overlay at each end.
   D. Apply overlay to moist panel surface & align small rectangular hole on the left & round holes at the extreme right and left of overlay with corresponding holes in metal panel.
   E. Smooth entire overlay surface (except unsupported keyboard area) with clean cloth or paper towel pad, wiping from center of overlay to each end. This procedure is to displace moisture and contact adhesive to panel surface and must be repeated for proper adhesive cure as specified. Check overlay/panel alignment.
   F. Bake sub-panel assembly in hot room for 24 hours (cure times are approximate)
      a. Cure panel assy 1 hour and smooth overlay surface per note 4F
      b. After 4 to 5 hours of cure, smooth overlay surface per note 4F
      c. Before removing sub-panel assy from hot room smooth overlay surface per note 4F.
3. Apply RTV No. 3145 , around groove in panel surface--See Detail "A". RTV must be flush or below surface. Lens, 3 & 4 to be flush with surface. Allow to cure overnight in hot room.
2. Clean all unpainted surfaces of panel with isopropyl alcohol and allow to dry.
1. Head of standoff must be flush with panel surface--cannot extend above surface.

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN CHERMACK	DATE 9-15-83	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR [illegible]	11/15	TITLE: ASSEMBLY, SUB PANEL
	RELEASE APPROV [illegible]	11/	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1 XX ± .030		
	DO NOT SCALE DWG		MODEL NO 603 · DWG NO 2006-00-1144 · REV A
	SCALE NONE		CODE IDENT 23338 · SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS RECORDER NO. A-3084

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
5	BRKT, PANEL SUPPORT	1400-01-1253	WVTK	1400-01-1253	2
3	LENS WINDOW, SMALL	1400-01-6620	WVTK	1400-01-6620	1
4	LENS WINDOW, LARGE	1400-01-6630	WVTK	1400-01-6630	1
1	SUB PANEL REF 3200-02-0003	1400-01-6642	WVTK	1400-01-6642	1
2	OVERLAY, FRONT PANEL MODEL 603	1400-01-6850	WVTK	1400-01-6850	1
6	STANDOFF, PRESS .687H, 6-32	SSO-632-22	PEM	2800-06-0008	6
7	SCREW, SOC CAP, CAD I 6-32X3/8	6-32 X 3/8 S.C.	CMRCL	2800-18-6106	4

WAVETEK PARTS LIST	TITLE ASSY. SUB PANEL	ASSEMBLY NO 1206-00-1144 PAGE 1	REV A

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE PARTS LIST ASSY, SUB PANEL
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1 XX ± .030		
	DO NOT SCALE DWG		MODEL NO 603 / DWG NO 1206-00-1144 / REV A
	SCALE		CODE IDENT 23338 / SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS RECORDED NO. A-3884

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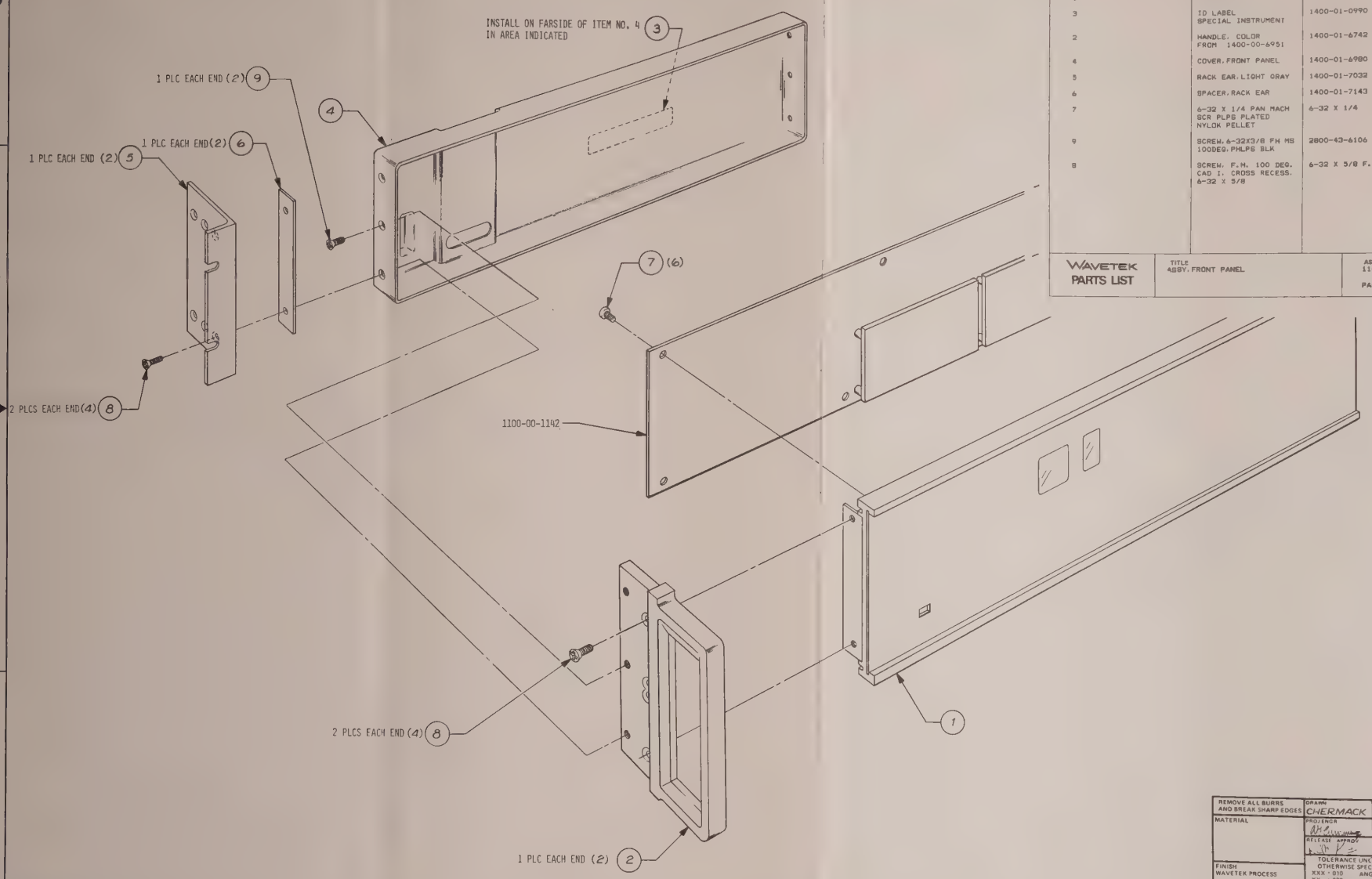
INSTALL ON FARSIDE OF ITEM NO. 4 IN AREA INDICATED
3
1 PLC EACH END (2) 9
4
1 PLC EACH END (2) 6
1 PLC EACH END (2) 5
7 (6)
2 PLCS EACH END (4) 8
1100-00-1142
2 PLCS EACH END (4) 8
1
1 PLC EACH END (2) 2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG, FRONT PANEL	0102-00-1143	WVTK	0102-00-1143	1
1	ASSY, SUB PANEL	603-1144	WVTK	1206-00-1144	1
3	ID LABEL SPECIAL INSTRUMENT	1400-01-0990	WVTK	1400-01-0990	1
2	HANDLE, COLOR FROM 1400-00-6951	1400-01-6742	WVTK	1400-01-6742	2
4	COVER, FRONT PANEL	1400-01-6980	WVTK	1400-01-6980	1
5	RACK EAR, LIGHT GRAY	1400-01-7032	WVTK	1400-01-7032	2
6	SPACER, RACK EAR	1400-01-7143	WVTK	1400-01-7143	2
7	6-32 X 1/4 PAN MACH SCR PLPS PLATED NYLOK PELLET	6-32 X 1/4	CMRCL	2800-23-6104	6
9	SCREW, 6-32X3/8 FH MS 100DEG, PHLPS BLK	2800-43-6106	WVTK	2800-43-6106	2
8	SCREW, F.H. 100 DEG. CAD I. CROSS RECESS, 6-32 X 5/8	6-32 X 5/8 F.H. 100	CMRCL	2800-44-6110	8

WAVETEK PARTS LIST	TITLE ASSY, FRONT PANEL	ASSEMBLY NO. 1101-00-1143 PAGE: 1	REV B

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN CHERMACK	DATE 9-15-83	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE ASSEMBLY, FRONT PANEL
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1 XX ±.030		
	DO NOT SCALE DWG		MODEL NO 603 DWG NO 0102-00-1143 REV A
	SCALE NONE		CODE IDENT 23338 SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REVISION NO. A-3867

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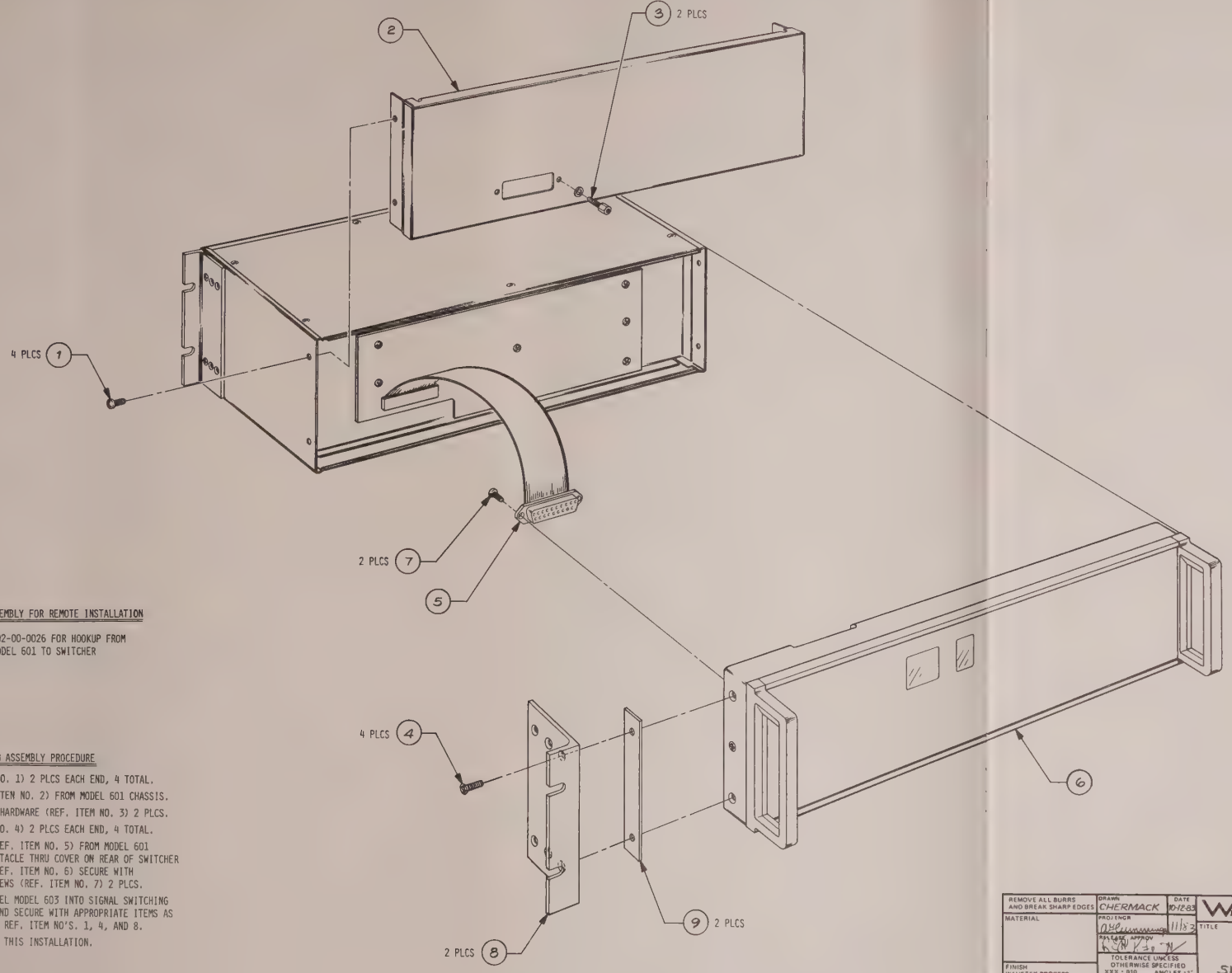
REV	ECN	BY	DATE	APP



CONTROL PANEL SWITCHING SYSTEM ASSEMBLY FOR REMOTE INSTALLATION

1. USE CABLE ASSEMBLY P/N 6002-00-0026 FOR HOOKUP FROM SIGNAL SWITCHING SYSTEM MODEL 601 TO SWITCHER CONTROL PANEL MODEL 603.

CONTROL PANEL SWITCHING SYSTEM ASSEMBLY PROCEDURE

1. REMOVE SCREWS (REF. ITEM NO. 1) 2 PLCS EACH END, 4 TOTAL.
2. REMOVE FRONT PANEL (REF. ITEM NO. 2) FROM MODEL 601 CHASSIS.
3. REMOVE CONNECTOR MOUNTING HARDWARE (REF. ITEM NO. 3) 2 PLCS.
4. REMOVE SCREWS (REF. ITEM NO. 4) 2 PLCS EACH END, 4 TOTAL.
5. MATE "D" CONNECTOR PLUG (REF. ITEM NO. 5) FROM MODEL 601 CHASSIS TO CONNECTOR RECEPTACLE THRU COVER ON REAR OF SWITCHER CONTROL PANEL MODEL 603 (REF. ITEM NO. 6) SECURE WITH NO. 4-40x1/4" PAN HEAD SCREWS (REF. ITEM NO. 7) 2 PLCS.
6. PLACE SWITCHER CONTROL PANEL MODEL 603 INTO SIGNAL SWITCHING SYSTEM MODEL 601 CHASSIS AND SECURE WITH APPROPRIATE ITEMS AS PER REQUIRED INSTALLATION, REF. ITEM NO'S. 1, 4, AND 8.
7. ITEM NO. 9 IS NOT USED FOR THIS INSTALLATION.

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN CHERMACK	DATE 10/1/83	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR	11/1/83	TITLE: ASSEMBLY CONTROL PANEL SWITCHING SYSTEM
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ±1° XX ± .030		
	DO NOT SCALE DWG	MODEL NO 601/603	DWG NO 0002-00-0211 REV A
	SCALE NONE	CODE IDENT 23338	SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-3994

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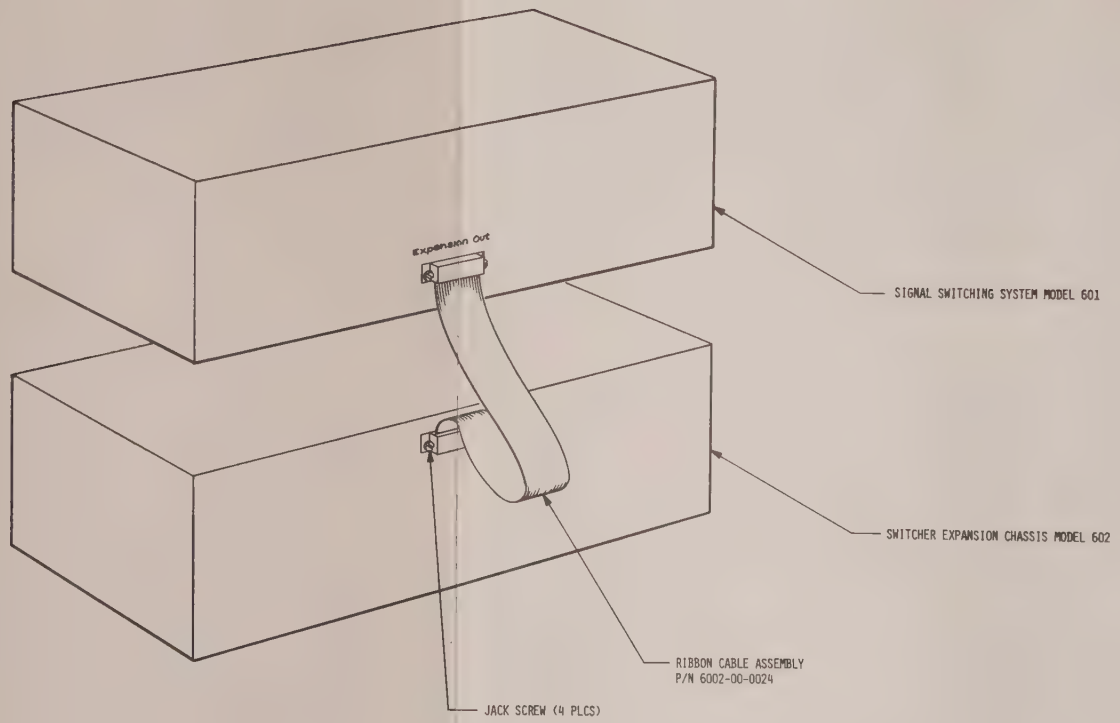
REV	ECN	BY	DATE	APP



INSTALLATION INSTRUCTIONS

1. INSTALL RIBBON CABLE ASSEMBLY P/N 6002-00-0024 BETWEEN "EXPANSION OUT" CONNECTOR ON MODEL 601 AND "EXPANSION IN" CONNECTOR ON MODEL 602. SECURE WITH JACK SCREWS 4 PLCS.
2. "WARNING" RIBBON CABLE ASSEMBLY DOES NOT GO TO "CONTROL IN" CONNECTOR!

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN CHERMACK	DATE 9-21-83	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ MGR [illegible]	11/1/83	TITLE ASSEMBLY DWG, EXPANSION CHASSIS SWITCHING SYSTEM
FINISH WAVETEK PROCESS	RELEASE APPROV [illegible] KD Klo		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1 XX ± .030		
	DO NOT SCALE DWG		MODEL NO 602 / DWG NO 0002-00-0210 / REV
	SCALE NONE		CODE IDENT 23338 / SHEET 1 OF 1

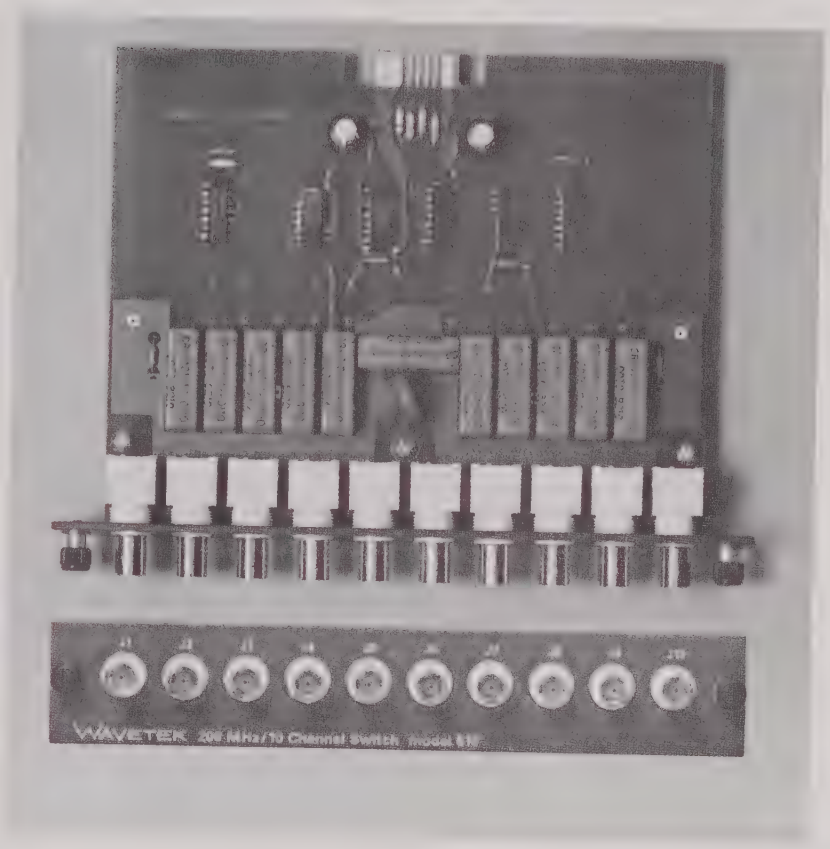
BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-3994

APPENDIX A
SWITCH MODULES

The following pages in this appendix contain information on the individual switching modules. These modules must be used in the 601 and 602 chassis.

INSTRUCTION MANUAL
MODEL 610
200 MHz, 10 CHANNEL MODULE

Model 610, a 200 MHz RF module, gives maximum flexibility with two sets of five relays in a modified star. Any I/O connector can be connected to any other or to multiple I/O connectors; all can be disconnected as well. The two groups of five relays can be connected together via another relay.



SPECIFICATIONS

Insertion Loss ≤0.75 db @ 100 MHz.
Bandwidth ≥200 MHz @ −3 dB.
Cross Talk Any channel to any channel; all switches open:

10 MHz	100 MHz	200 MHz
≤ −75 dB	≤ −55 dB	≤ −50 dB

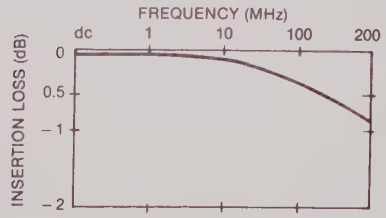
Isolation One signal path, input to output; one switch open:

10 MHz	100 MHz	200 MHz
≤ −55 dB	≤ −40 dB	≤ −35 dB

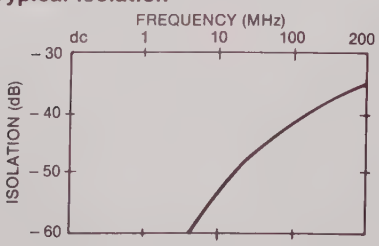
Risetime ≤2.0 ns.
Maximum V/A/W 200V, 0.5A 10W.
Contact Resistance ≤0.15Ω/sw.
VSWR (Typical) ≤1.1:1 @ 25 MHz, ≤1.2:1 @ 95 MHz.
Switching Time ≤2 ms.
I/O Connections 10 BNC, female.
Power Consumption
1.0 W max @ 12V;
0.1 W per switch.

SUPPLEMENTAL INFORMATION

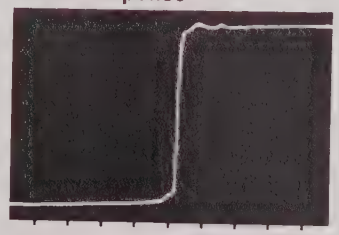
Typical Insertion Loss



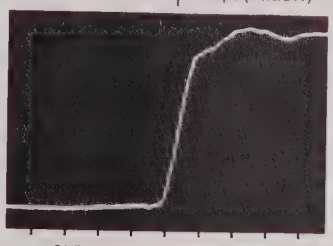
Typical Isolation



Typical Sub-nanosecond Pulse Response

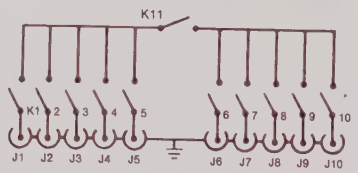


INPUT WAVEFORM T_r = 200ps (1 ns/DIV)



OUTPUT WAVEFORM (1 ns/DIV)

SWITCH DIAGRAM



Specifications subject to change.

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WAVETEK SAN DIEGO, INC.
9045 Balboa Ave., San Diego, CA 92123
P. O. Box 85265, San Diego, CA 92138
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P11/83 S11/83

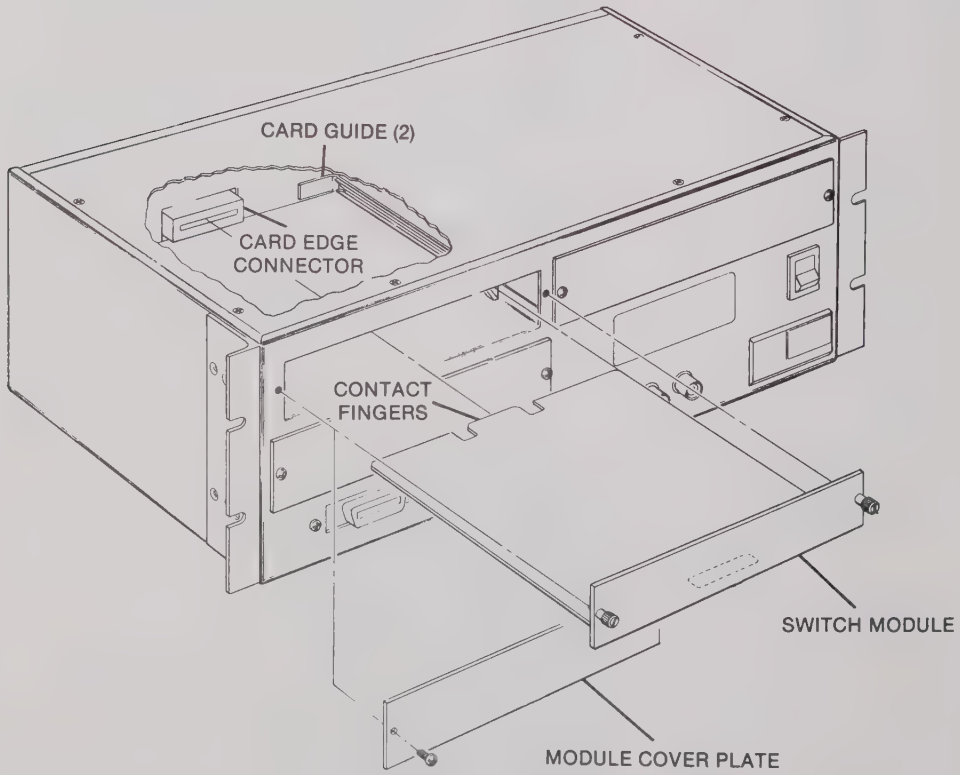
INSTALLATION AND USE

The Model 610 switch module can be installed into any available module slot within the 601 chassis or 602 expansion chassis. To install the module, refer to the installation figure and the following procedure.

1. Turn the 601 power off.
2. Remove the two screws and the module cover plate.
3. Insert the switch module into the card guides (both sides) and push the moduleinto the chassis. The contact fingers on the switch module printed circuit board must engage the card edge connector in the chassis.
4. Fasten the two captive screws on the switch module.

Once installed, the 610 module provides a 9-bit code that identifies the model number of the module and the number of relays in the module. This code along with the module's slot number is stored in the 601's memory during the power-up routine.

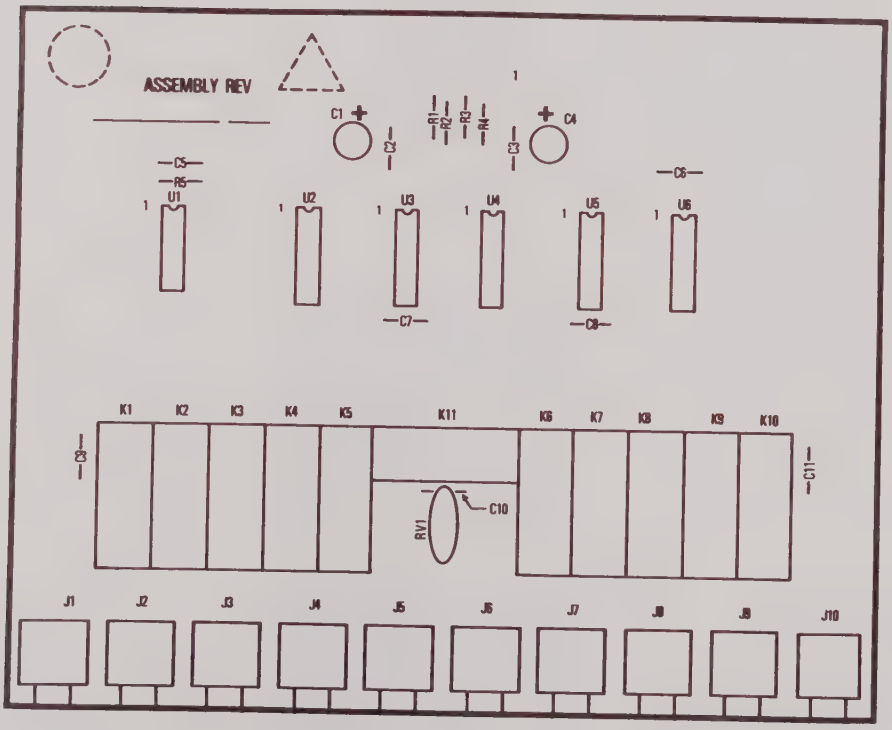
For specific programming information, refer to Section 3 of the Model 600 manual. See the switch diagram on page 1 for relay configuration and signal connections. Signal connections are made using the ten BNC connectors located on the module faceplate.

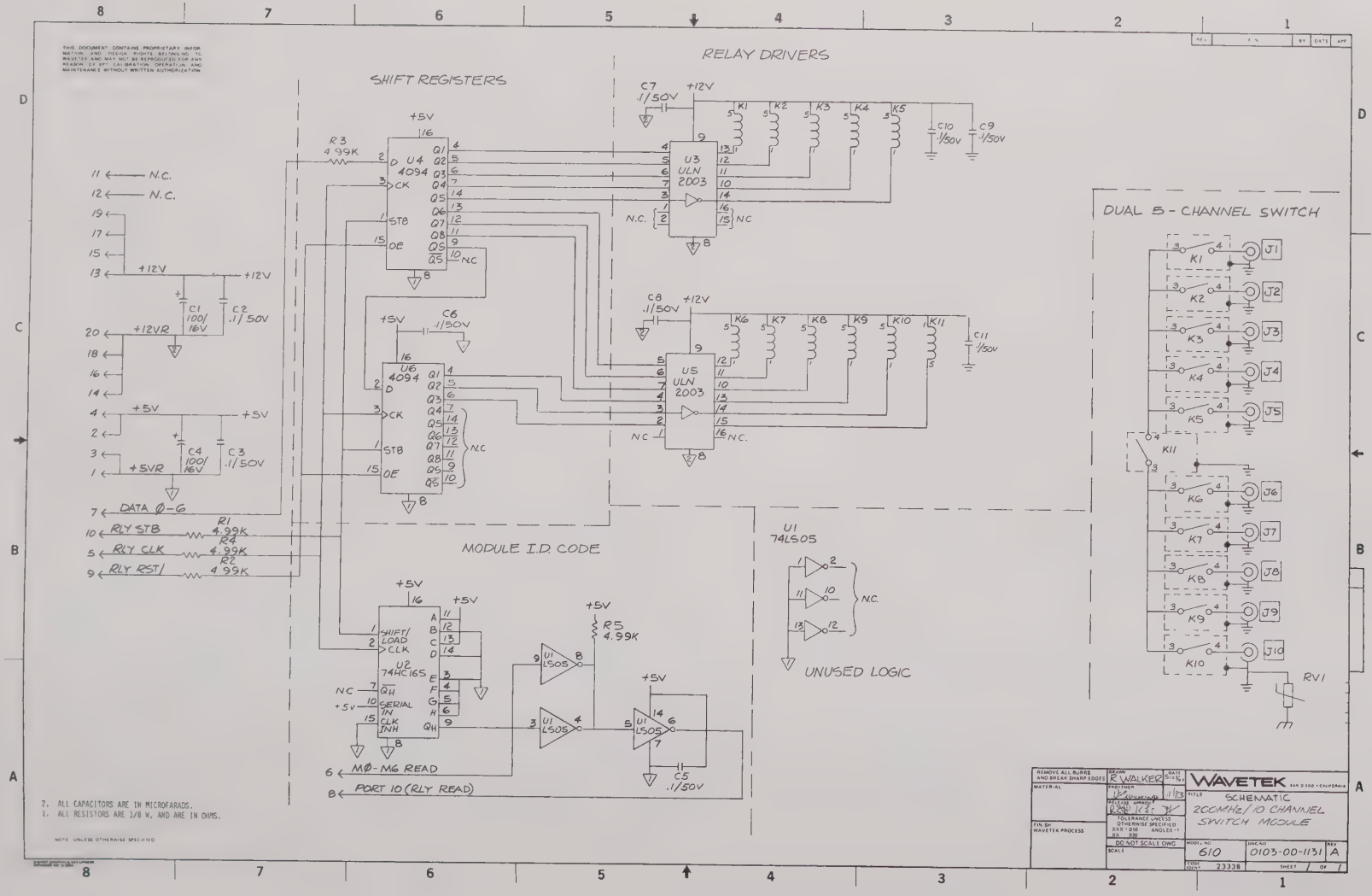


Installation Drawing

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
1	FACE PLATE, MODULE REF: 3200-06-0035	1400-01-6800	WVTK	1400-01-6800	1
C10 C11 C2 C3 C5 C6 C7 C8 C9	CAP, CER, MON, .1MF, 50V	CAC03Z5U104Z050A	CORNG	1500-01-0405	9
C1 C4	CAP, ELECT, 100MF, 25V RADIAL LEAD, SP .20	CRE SERIES 100/25	CAPAR	1500-31-0102	2
3	200MHZ/10 CHANNEL BD	1700-00-1131	WVTK	1700-00-1131	1
J1 J10 J2 J3 J4 J5 J6 J7 J8 J9	CONNECTOR, BNC(PC)	227161-1	AMP	2100-01-0019	10
K1 K10 K11 K2 K3 K4 K5 K6 K7 K8 K9	RELAY, REED	CR-7101-12-0110	CDTO	4500-00-0020	11
R1 R2 R3 R4 R5	RES, MF, 1/8W, 1%, 4.99K	RN55D-4991F	TRW	4701-03-4991	5
RV1	VARISTOR	V56ZA8	GE	4799-00-0048	1
U3 U5	IC	ULN2003A	SPRAG	7000-20-0300	2
U4 U6	IC	CD4094BE	RCA	8000-40-9400	2
U1	IC	74LS05	TI	8000-74-0510	1
U2	IC, SHIFT REGISTER	74HC165	MOT	8007-41-6340	1

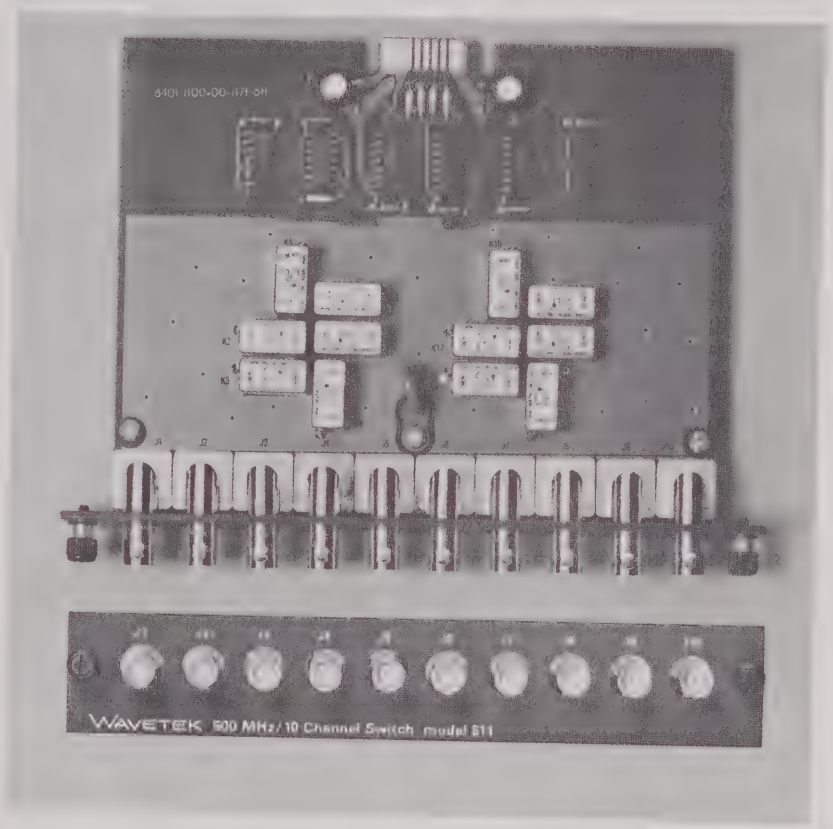
WAVETEK PARTS LIST	TITLE PCA, 200MHZ/10 CH SWITCH MODULE	ASSEMBLY NO. 1100-00-1131	REV B




SHIFT REGISTERS
RELAY DRIVERS
DUAL 5 - CHANNEL SWITCH
MODULE I.D. CODE
UNUSED LOGIC
U4 4094
U6 4094
U3 ULN 2003
U5 ULN 2003
U2 74HC165
U1 74LS05
+5V
+12V
+12VR
+5VR
R1 4.99K
R2 4.99K
R3 4.99K
R4 4.99K
R5 4.99K
C1 100/16V
C2 .1/50V
C3 .1/50V
C4 100/16V
C5 .1/50V
C6 .1/50V
C7 .1/50V
C8 .1/50V
C9 .1/50V
C10 .1/50V
C11 .1/50V
N.C.
DATA Ø-6
RLY STB
RLY CLK
RLY RST/
MØ-M6 READ
PORT 10 (RLY READ)
RV1
J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
K1
K2
K3
K4
K5
K6
K7
K8
K9
K10
K11
2. ALL CAPACITORS ARE IN MICROFARADS.
1. ALL RESISTORS ARE 1/8 W, AND ARE IN OHMS.
WAVETEK
SCHEMATIC
200MHz/10 CHANNEL SWITCH MODULE
MODEL NO 610
DWG NO 0103-00-1131
REV A
SHEET 1 OF 1

INSTRUCTION MANUAL
MODEL 611
500 MHz, 10 CHANNEL MODULE

Model 611, a 500 MHz RF module, gives maximum connection flexibility by providing two sets of five relays in a modified star configuration.



SPECIFICATIONS

Insertion Loss ≤0.5 dB @ 100 MHz.
Bandwidth ≥500 MHz @ −3 dB.
Rise Time ≤1.0 ns.
Cross Talk Any channel to any channel; all switches open:

10 MHz	100 MHz	500 MHz
≤ −100 dB	≤ −90 dB	≤ −60 dB

Isolation One signal path, input to output; one switch open:

10 MHz	100 MHz	500 MHz
≤ −70 dB	≤ −60 dB	≤ −50 dB

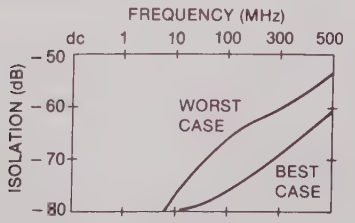
Maximum V/A/W 100V, 2A 60W.
Contact Resistance ≤0.10Ω/switch.
VSWR (Typical) ≤1.1:1 @ 25 MHz,
≤1.2:1 @ 95 MHz.
Switching Time ≤10 ms.
I/O Connections 10 BNC, female.
Power Consumption
3.3 W max @ 12V;
0.3 W per switch.

Specifications subject to change

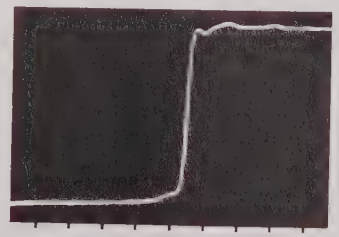
SUPPLEMENTAL INFORMATION

Typical Insertion Loss

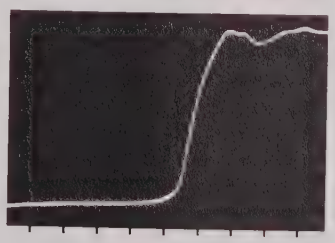
Typical Isolation



Typical Sub-nanosecond Pulse Response

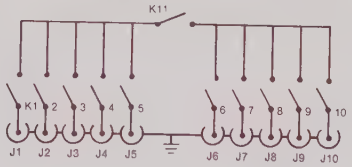


INPUT WAVEFORM, T_r = 200ps (500ps/DIV)



OUTPUT WAVEFORM (500ps/DIV)

SWITCH DIAGRAM



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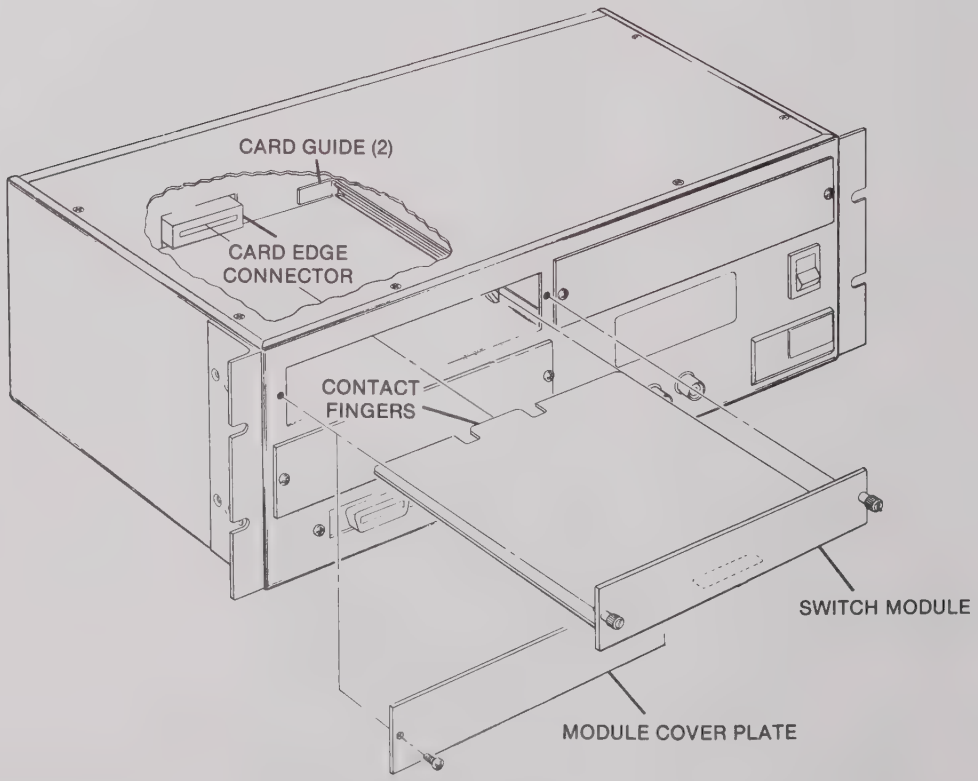
INSTALLATION AND USE

The Model 611 switch module can be installed into any available module slot within the 601 chassis or 602 expansion chassis. To install the module, refer to the installation figure and the following procedure.

1. Turn the 601 power off.
2. Remove the two screws and the module cover plate.
3. Insert the switch module into the card guides (both sides) and push the module into the chassis. The contact fingers on the switch module printed circuit board must engage the card edge connector in the chassis.
4. Fasten the two captive screws on the switch module.

Once installed, the 611 module provides a 9-bit code that identifies the model number of the module and the number of relays in the module. This code along with the module's slot number is stored in the 601's memory during the power-up routine.

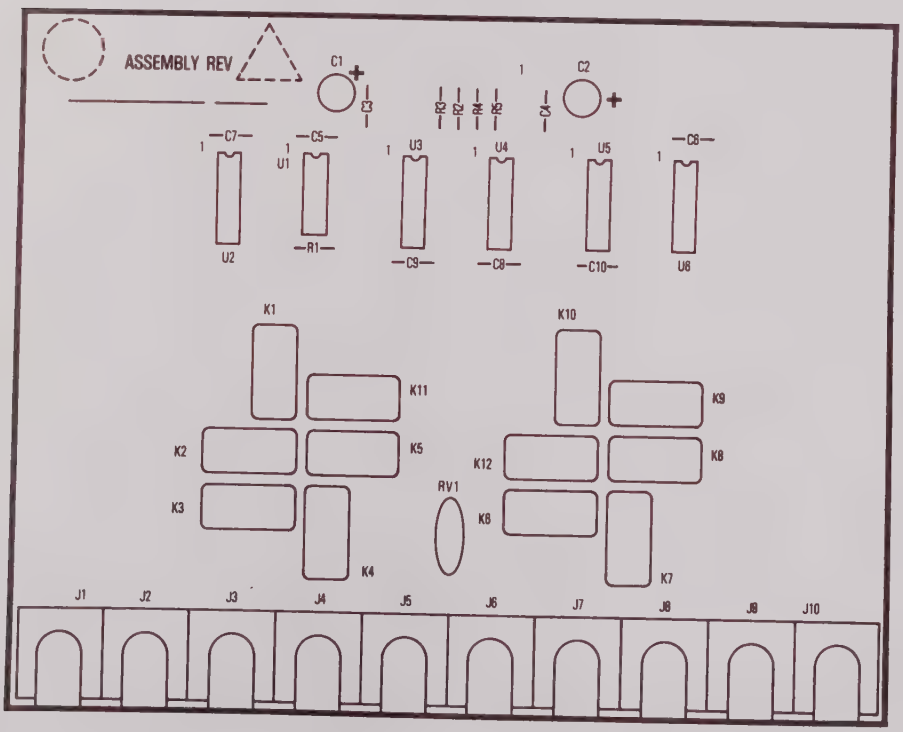
For specific programming information, refer to Section 3 of the Model 600 manual. See the switch diagram on page 1 for relay configuration and signal connections. Signal connections are made using the ten BNC connectors located on the module faceplate.

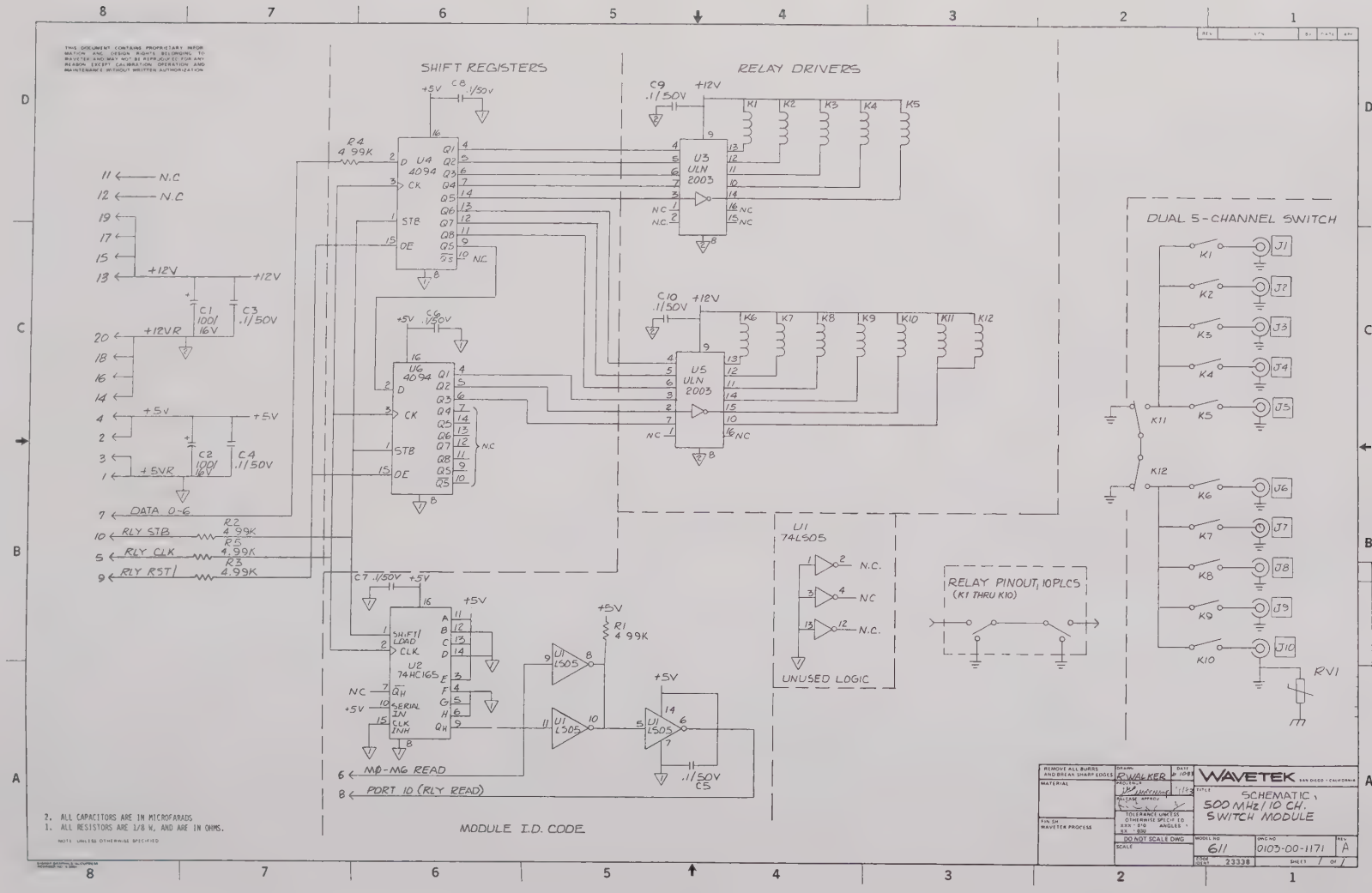


Installation Drawing

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
1	FACE PLATE, MODULE FROM: 1400-01-6822	1400-01-6829	WVTK	1400-01-6829	1
C10 C3 C4 C5 C6 C7 C8 C9	CAP, CER, MON, .1MF, 50V	CAC03Z5U104Z050A	CORNG	1500-01-0405	8
C1 C2	CAP, ELECT, 100MF, 25V RADIAL LEAD, SP .20	CRE SERIES 100/25	CAPAR	1500-31-0102	2
3	500 MHZ 10 CHANNEL SWITCH MODULE BD	1700-00-1171	WVTK	1700-00-1171	1
J1 J10 J2 J3 J4 J5 J6 J7 J8 J9	CONN, BNC, PC MOUNT RIGHT ANGLE	KC-79-237M06	KINGS	2100-01-0020	10
2	SCREW, CAPTIVE, FLOATING	F7500-P-6-8-1	DUTCH	2800-03-0019	2
4	6-32 X 1/4 PAN MACH SCR PLPS PLATED NYLOK PELLET	6-32 X 1/4	CMRCL	2800-23-6104	3
K1 K10 K11 K12 K2 K3 K4 K5 K6 K7 K8 K9	RELAY, 12V COIL, METAL CAN	HFW12103J301	CII	4500-00-0025	12
R1 R2 R3 R4 R5	RES, MF, 1/8W, 1%, 4.99K	RN55D-4991F	TRW	4701-03-4991	5
RV1	VARISTOR	V56ZA8	GE	4799-00-0048	1
U3 U5	IC	ULN2003A	SPRAG	7000-20-0300	2
U4 U6	IC	CD4094BE	RCA	8000-40-9400	2
U1	IC	74LS05	TI	8000-74-0510	1
U2	IC, SHIFT REGISTER	74HC165	MOT	8007-41-6540	1

WAVETEK PARTS LIST	TITLE PCA, 500MHZ/10 CH SWITCH MODULE	ASSEMBLY NO. 1100-00-1171	REV B




SHIFT REGISTERS
RELAY DRIVERS
DUAL 5-CHANNEL SWITCH
U4 4094
U6 4094
U2 74HC165
U3 ULN 2003
U5 ULN 2003
U1 74LS05
R1 4.99K
R2 4.99K
R3 4.99K
R4 4.99K
R5 4.99K
C1 100/16V
C2 100/16V
C3 .1/50V
C4 .1/50V
C5 .1/50V
C7 .1/50V
C8 .1/50V
C9 .1/50V
C10 .1/50V
+12V
+12VR
+5V
+5VR
N.C
DATA 0-6
RLY STB
RLY CLK
RLY RST
SHIFT/LOAD CLK
SERIAL IN CLK INH
MB-MG READ
PORT 10 (RLY READ)
UNUSED LOGIC
RELAY PINOUT, 10PLCS (K1 THRU K10)
K1
K2
K3
K4
K5
K6
K7
K8
K9
K10
K11
K12
J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
RV1
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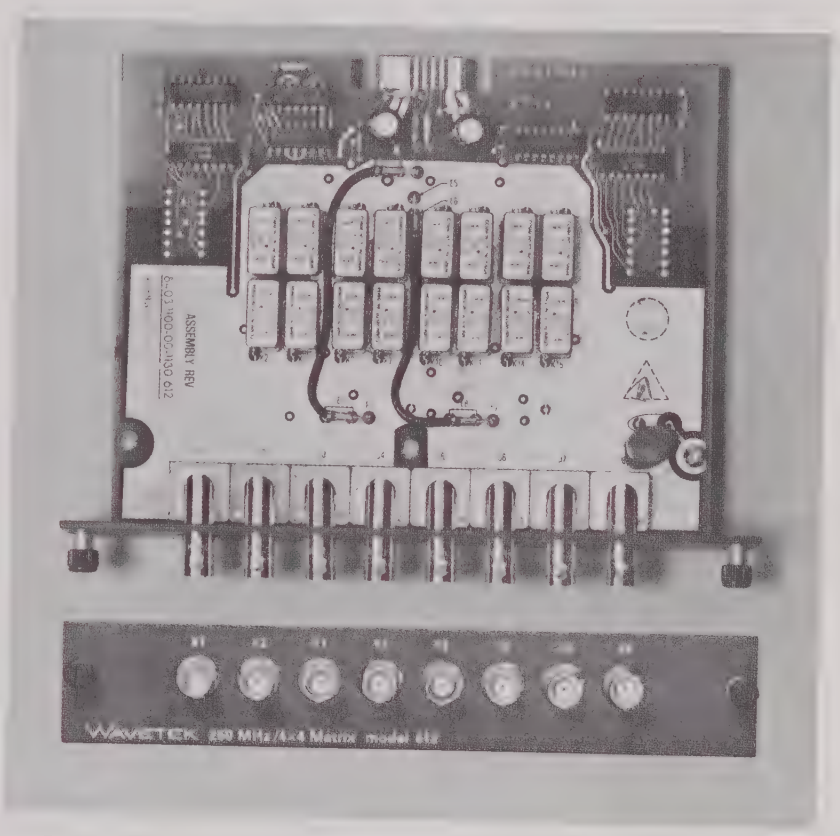
2. ALL CAPACITORS ARE IN MICROFARADS
1. ALL RESISTORS ARE 1/8 W, AND ARE IN OHMS.
MODULE I.D. CODE
WAVETEK SAN DIEGO, CALIFORNIA
SCHEMATIC, 500 MHz/10 CH. SWITCH MODULE
611
0103-00-1171
A
23338

INSTRUCTION MANUAL
MODEL 612
250 MHz, MATRIX MODULE

Model 612, a 250 MHz RF module, gives the ultimate in switching flexibility. The module is a 4 × 4 matrix allowing any port to be connected to any other port independently or all together and at the same time.



SPECIFICATIONS

Insertion Loss ≤0.75 dB @ 100 MHz.
Bandwidth ≥250 MHz @ −3 dB.
Rise Time ≤2.0 ns.
Cross Talk Any channel to any channel; all switches open:

10 MHz	100 MHz	250 MHz
≤ −75 dB	≤ −70 dB	≤ −60 dB

Isolation One signal path, input to output; one switch open:

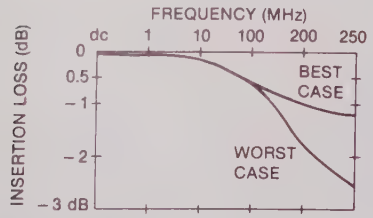
10 MHz	100 MHz	250 MHz
≤ −70 dB	≤ −60 dB	≤ −50 dB

Maximum V/A/W 100V, 2A, 60W.
Contact Resistance ≤0.15Ω/switch.
VSWR (Typical) ≤1.1:1 @ 10 MHz, ≤1.35:1 @ 50 MHz.
Switching Time ≤10 ms.
I/O Connections 8 BNC, female.
Power Consumption
4.5 W max @ 12V; 0.3 W per switch.

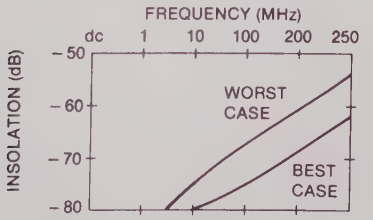
Specifications subject to change

SUPPLEMENTAL INFORMATION

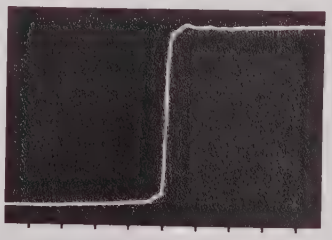
Typical Insertion Loss



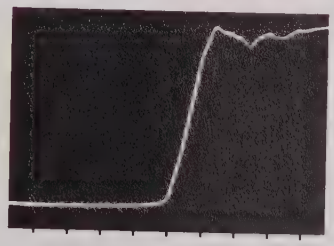
Typical Isolation



Typical Sub-nanosecond Pulse Response

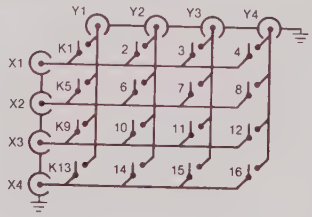


INPUT WAVEFORM T_r = 200ps (1 ns/DIV)



OUTPUT WAVEFORM (1 ns/DIV)

SWITCH DIAGRAM



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P11/83 S11/83

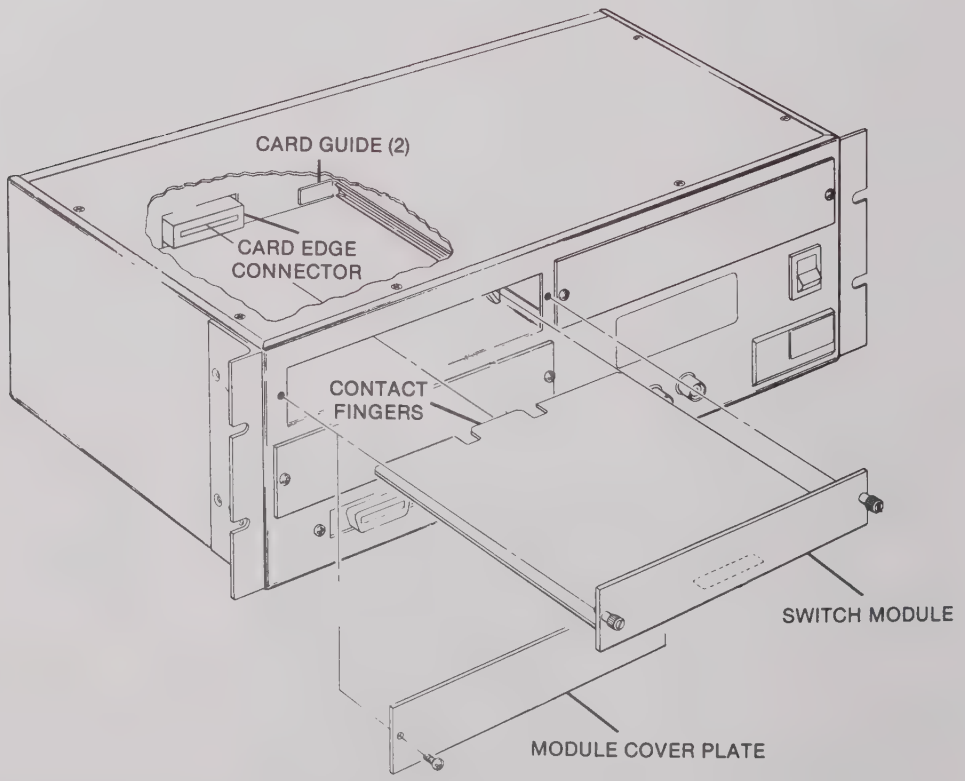
INSTALLATION AND USE

The Model 612 switch module can be installed into any available module slot within the 601 chassis or 602 expansion chassis. To install the module, refer to the installation figure and the following procedure.

1. Turn the 601 power off.
2. Remove the two screws and the module cover plate.
3. Insert the switch module into the card guides (both sides) and push the module into the chassis. The contact fingers on the switch module printed circuit board must engage the card edge connector in the chassis.
4. Fasten the two captive screws on the switch module.

Once installed, the 612 module provides a 9-bit code that identifies the model number of the module and the number of relays in the module. This code along with the module's slot number is stored in the 601's memory during the power-up routine.

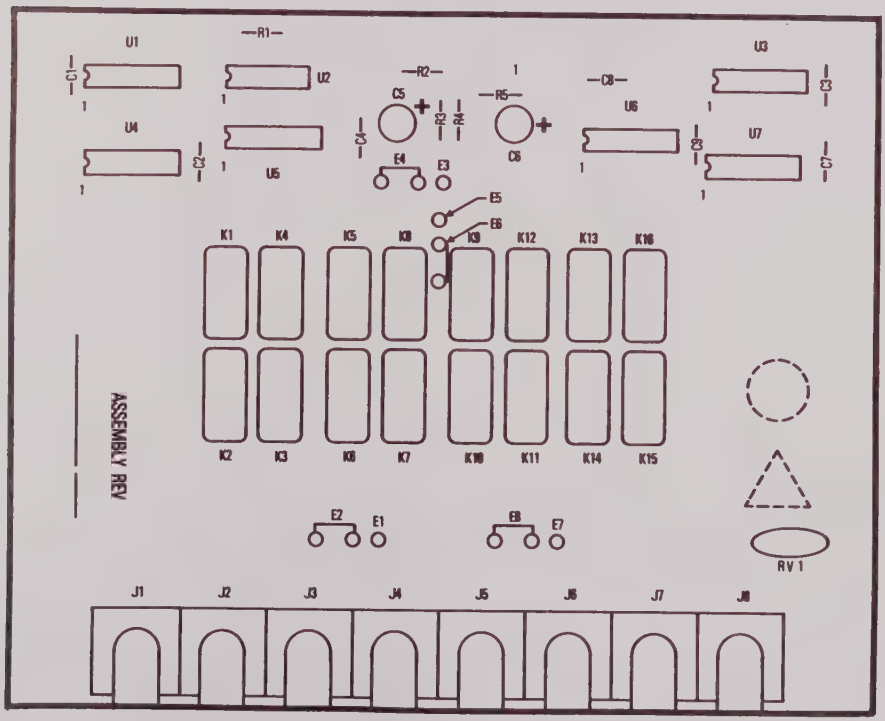
For specific programming information, refer to Section 3 of the Model 600 manual. See the switch diagram on page 1 for relay configuration and signal connections. Signal connections are made using the eight BNC connectors located on the module faceplate.

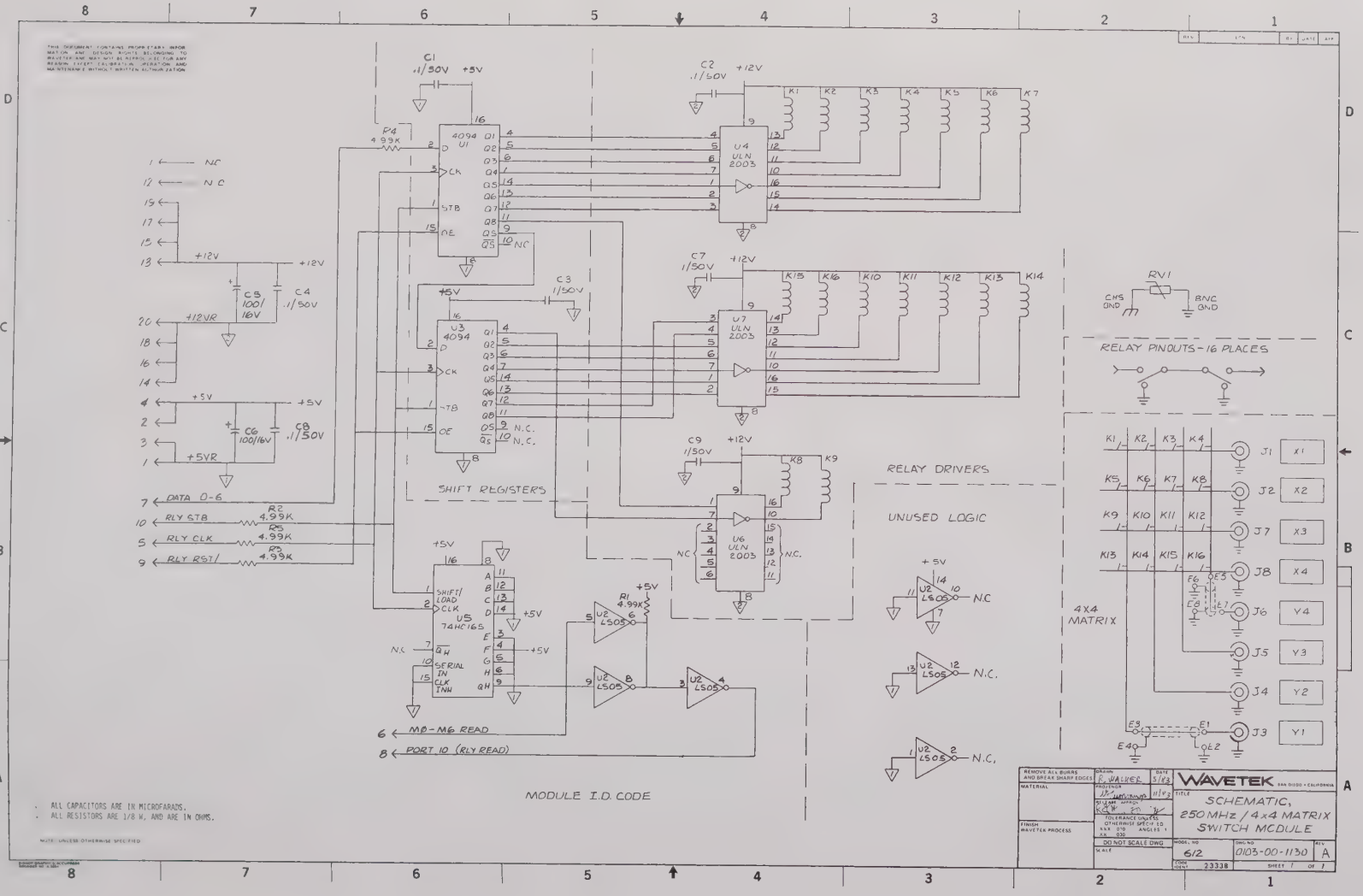


Installation Drawing

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
1	FACE PLATE REF: 3200-06-0035	1400-01-7560	WVTK	1400-01-7560	1
C1 C2 C3 C4 C7 C8 C9	CAP, CER, MON, .1MF, 50V	CAC03Z5U104Z050A	CORNG	1500-01-0405	7
C5 C6	CAP, ELECT, 100MF/16V RADIAL LEAD, SP .20	CRE SERIES 100/16	CAPAR	1500-31-0111	2
3	250 MHZ/4X4 MATRIX	1700-00-1130	WVTK	1700-00-1130	1
J1 J2 J3 J4 J5 J6 J7 J8	CONN, BNC, PC MOUNT RIGHT ANGLE	KC-79-237M06	KINGS	2100-01-0020	8
4	COAX BRAID TERMINATION	226176-4	AMP	2100-04-0037	4
2	SCREW, CAPTIVE, FLOATING	F7500-P-6-B-1	DUTCH	2800-03-0019	2
5	6-32 X 1/4 PAN MACH SCR PLPS PLATED NYLOK PELLET	6-32 X 1/4	CMRCL	2800-23-6104	3
K1 K10 K11 K12 K13 K14 K15 K16 K2 K3 K4 K5 K6 K7 K8 K9	RELAY, 12V COIL, METAL CAN	HFW12103J301	CII	4500-00-0025	16
R1 R2 R3 R4 R5	RES, MF, 1/8W, 1%, 4.99K	RN55D-4991F	TRW	4701-03-4991	5
RV1	VARISTOR	V56ZAB	GE	4799-00-0048	1
6	CABLE, COAX, 26AWG	RG 174/U	ITT	6001-40-0001	1
U4 U6 U7	IC	ULN2003A	SPRAG	7000-20-0300	3
U1 U3	IC	CD4094BE	RCA	8000-40-9400	2
U2	IC	74LS05	TI	8000-74-0510	1
U5	IC, SHIFT REGISTER	74HC165	MOT	8007-41-6540	1

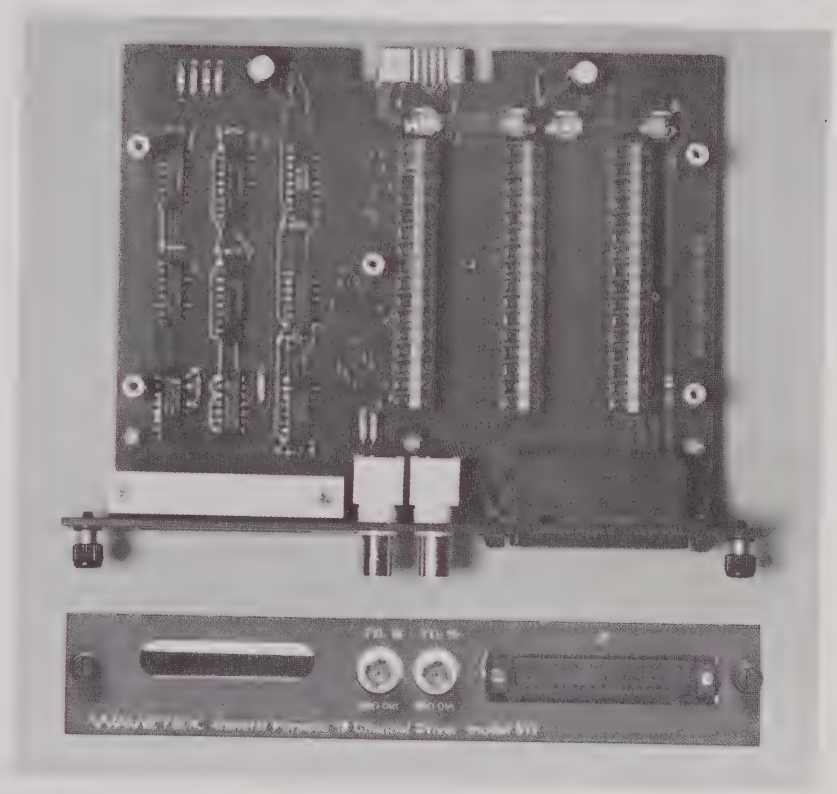
WAVETEK PARTS LIST	TITLE PCA, 250MHZ 4X4 MATRIX SWITCH MODULE	ASSEMBLY NO. 1100-00-1216	REV




C1 .1/50V +5V
C2 .1/50V +12V
C7 1/50V +12V
C3 1/50V
C9 1/50V +12V
U1 4094
U3 4094
U4 ULN 2003
U7 ULN 2003
U6 ULN 2003
U5 74HC165
C5 100/16V
C4 .1/50V
C6 100/16V
C8 .1/50V
+12VR
+5VR
R4 4.99K
R5 4.99K
R6 4.99K
R1 4.99K
DATA 0-6
RLY STB
RLY CLK
RLY RST/
SHIFT REGISTERS
RELAY DRIVERS
UNUSED LOGIC
RELAY PINOUTS - 16 PLACES
RV1
CHS GND
BNC GND
4X4 MATRIX
MD-M6 READ
PORT 10 (RLY READ)
MODULE I.D. CODE
ALL CAPACITORS ARE IN MICROFARADS.
ALL RESISTORS ARE 1/8 W, AND ARE IN OHMS.
WAVETEK SAN DIEGO, CALIFORNIA
SCHEMATIC, 250 MHz / 4x4 MATRIX SWITCH MODULE
DRAWN E. WALKER 5/83
APPROVED 11/83
MODEL NO 6/2
DWG NO 0103-00-1130
REV A
SHEET 1 OF 1

INSTRUCTION MANUAL
MODEL 613
16 CHANNEL DRIVER MODULE

Model 613, a general purpose driver module, can drive devices external to the module, such as your own microwave switches, which may require a +12V level, or other devices that require a TTL signal or combination of TTL signals. It provides 16 channels of both TTL level drive and parallel 12V, 300mA open collector drive. To conveniently trigger external devices, two channels have additional BNC outputs. A fused +12V and +5V supply is available.

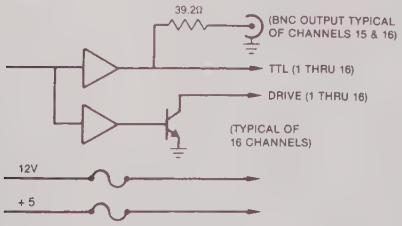


SPECIFICATIONS

I/O Connections 50 pin subminiature "D" connector and 48 screw terminals.
TTL Output +20/−10 mA maximum per channel.
Max Collector Voltage +40 Vdc.
Max Collector Current 200 mA.
+5V Supply 100 mA maximum load.
+12V Supply 300 mA maximum load.
Output Power Available
3.6 W max @ 12V;
1.0 W max @ 5V.

Specifications subject to change.

SWITCH DIAGRAM



J3 PIN LOCATIONS

J3 PIN FUNCTIONS

Function	Pin Number	Function	Pin Number
12V ret.	1	TTL9	39
12V ret.	18	TTL10	40
12V ret.	34	TTL11	23
12V ret.	35	TTL12	7
12V	2	TTL13	41
12V	3	TTL14	24
12V	19	TTL15	8
12V	36	TTL16	25
+5V ret.	4	Drive 1	12
+5V ret.	5	Drive 2	29
+5V ret.	20	Drive 3	13
+5V ret.	37	Drive 4	30
+5V	6	Drive 5	14
+5V	21	Drive 6	31
+5V	22	Drive 7	15
+5V	38	Drive 8	32
TTL1	28	Drive 9	16
TTL2	11	Drive 10	17
TTL3	27	Drive 11	33
TTL4	10	Drive 12	50
TTL5	26	Drive 13	46
TTL6	9	Drive 14	47
TTL7	43	Drive 15	48
TTL8	42	Drive 16	49

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P11/83 S11/83

INSTALLATION AND USE

The Model 613 switch module can be installed into any available module slot within the 601 chassis or 602 expansion chassis. to install the module, refer to the installation figure and the following procedure.

1. Turn the 601 power off.
2. Remove the two screws and the module cover plate.
3. Insert the switch module into the card guides (both sides) and push the module into the chassis. The contact fingers on the switch module printed circuit board must engage the card edge connector in the chassis.
4. Fasten the two captive screws on the switch module.

Once installed, the 613 module provides a 9-bit code that identifies the model number of the module and the number of relays in the module. This code along with the module's slot number is stored in the 601's memory during the power-up routine.

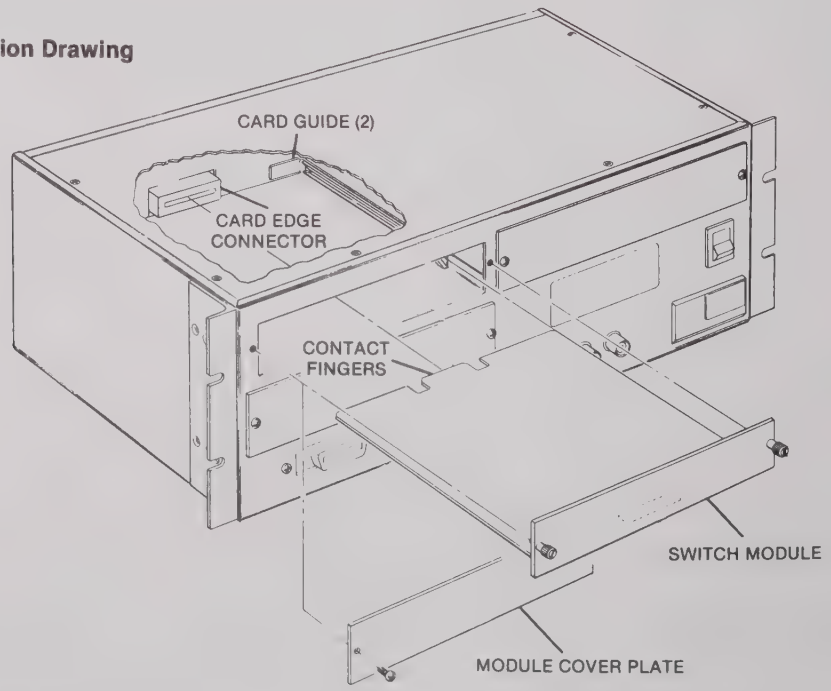
For specific programming information refer to Section 3 Operation of the Model 600 manual. See the switch diagram on page 1 for switch configuration. For signal connections, using the 50 pin D connector, refer to the table on page 1. For the signal connections using the terminal strips, refer to the schematic on page 4 and the assembly drawing on page 3. Use the following procedure along with information provided on the schematic (page 4) and the assembly drawing (page 3) to connect the signal wires to the internal terminal strips.

1. Remove the module from the chassis; power must be off.
2. Remove the top plastic cover (2 screws).
3. Remove the metal-foam cable clamp (2 screws) located on the left side of the module faceplate.
4. Strip the end of the signal wires to approximately 6.3mm (¼ in.).
5. Route the wire through the opening in the module faceplate.
6. Connect the wires to the desired screw terminal. Then, tighten the screw.
7. Replace the metal-foam cable clamp (2 screws) after all wires are installed and secure.
8. Install the top plastic cover (2 screws).
9. Install the module in the chassis.

In addition, two BNCs located on the module faceplate allow direct connection to either the TTL 15 and TTL 16 signals.

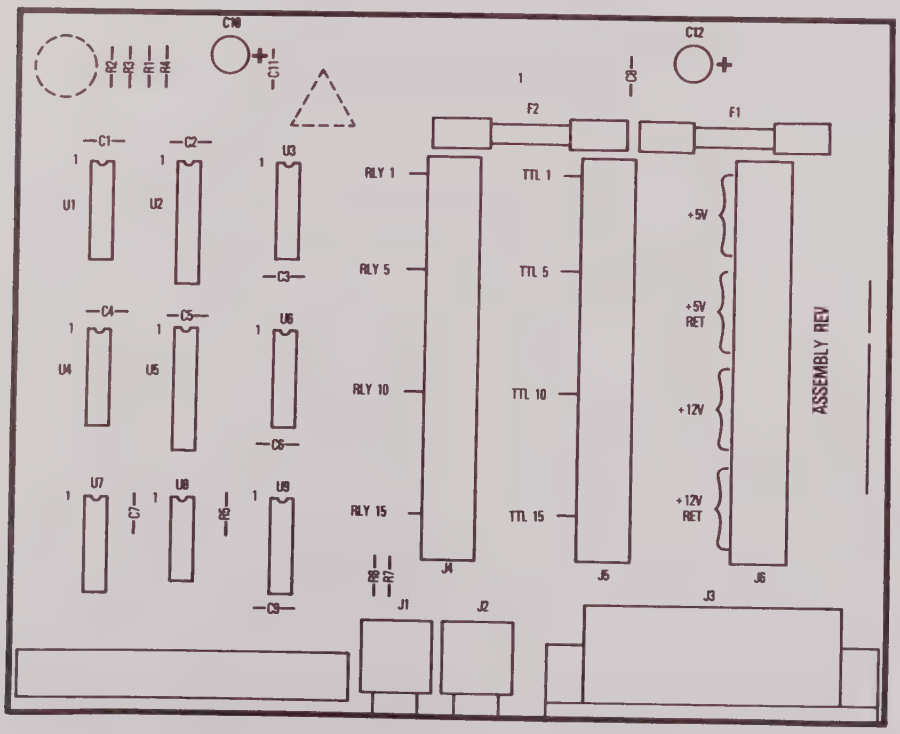
The +5V and +12V supply fuses are located on the module printed circuit board.

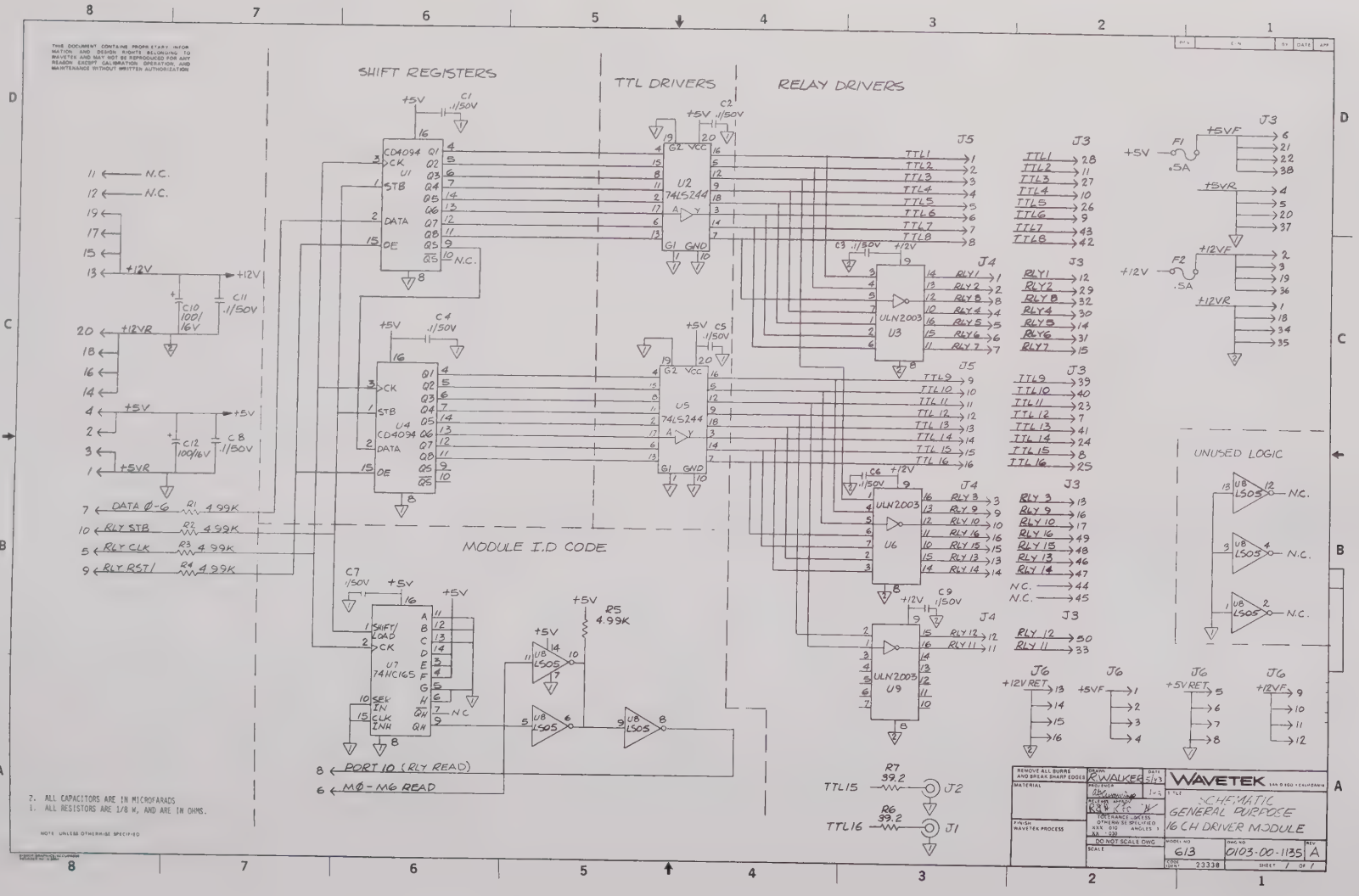
Installation Drawing



REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
1	FACE PLATE, MODULE REF: 3200-06-0035	1400-01-6810	WVTK	1400-01-6810	1
3	CLAMP, BAR, LOWER	1400-01-6883	WVTK	1400-01-6883	1
4	CLAMP, BAR, UPPER	1400-01-6893	WVTK	1400-01-6893	1
5	HOLDER, WIRE, FOAM	1400-01-7000	WVTK	1400-01-7000	2
6	COVER, SHIELD, MODULE	1400-01-7040	WVTK	1400-01-7040	1
C1 C11 C2 C3 C4 C5 C6 C7 C8 C9	CAP, CER, MON, .1MF, 50V	CAC03Z5U104Z050A	CORNG	1500-01-0405	10
C10 C12	CAP, ELECT, 100MF, 25V RADIAL LEAD, SP .20	CRE SERIES 100/25	CAPAR	1500-31-0102	2
B	GENERAL PURPOSE 16 CHANNEL BOARD	1700-00-1135	WVTK	1700-00-1135	1
J1 J2	CONNECTOR, BNC(PC)	227161-1	AMP	2100-01-0019	2
J3	CONNECTOR, "D" 50 PIN RIGHT ANGLE PC MOUNT	DSRST50RA02	VKING	2100-02-0150	1
J4 J5 J6	TERMINAL STRIP 16 PIN PC MOUNT	25.135.1653	ELECT	2100-09-0017	3
F1 F2	FUSE, 1/2A, 250V	312.500	LITFU	2400-05-0006	2
9	FUSE HOLDER, CLIP	102071	LITFU	2400-05-0031	4
R6 R7	RES, MF, 1/8W, 1%, 39.2	RN55D-39R2F	TRW	4701-03-3929	2
R1 R2 R3 R4 R5	RES, MF, 1/8W, 1%, 4.99K	RN55D-4991F	TRW	4701-03-4991	5
U3 U6 U9	IC	ULN2003A	SPRAG	7000-20-0300	3
U1 U4	IC	CD4094BE	RCA	8000-40-9400	2
U8	IC	74LS05	TI	8000-74-0510	1
U7	IC, SHIFT REGISTER	74HC165	MOT	8007-41-6540	1
U2 U5	IC	74LS244	TI	8007-42-4410	2

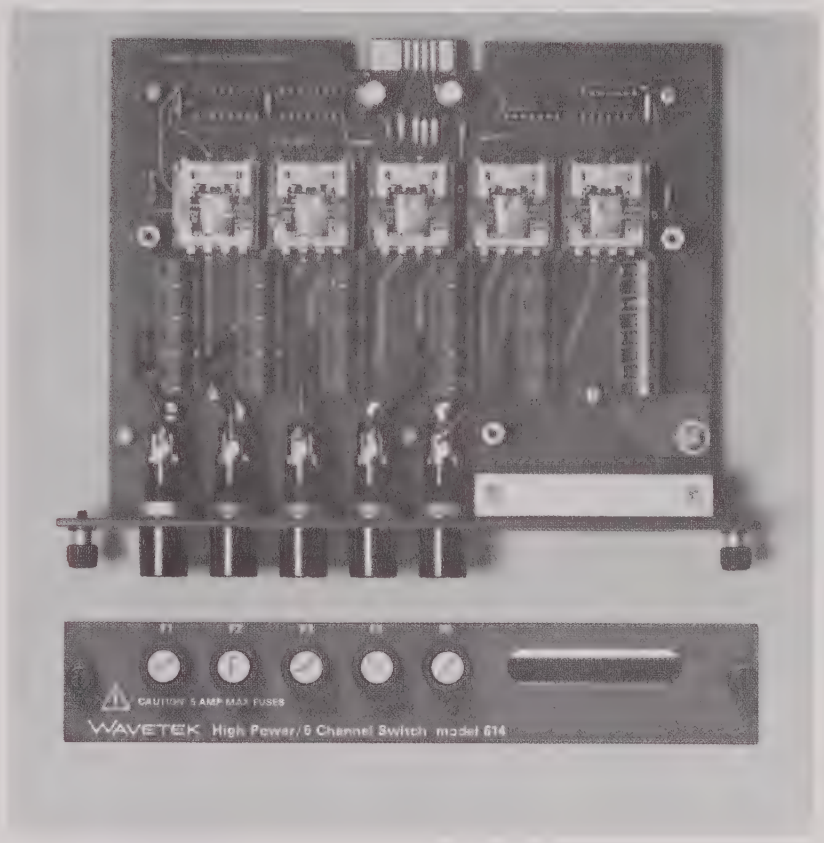
WAVETEK PARTS LIST	TITLE: PCA, GENERAL PURPOSE 16 CHANNEL DRIVER MODULE	ASSEMBLY NO. 1100-00-1135	REV B




SHIFT REGISTERS
TTL DRIVERS
RELAY DRIVERS
MODULE I.D CODE
UNUSED LOGIC
DATA Ø-6
RLY STB
RLY CLK
RLY RST/
PORT 10 (RLY READ)
MØ-M6 READ
TTL15
TTL16
7. ALL CAPACITORS ARE IN MICROFARADS
1. ALL RESISTORS ARE 1/8 W, AND ARE IN OHMS.
WAVETEK
SCHEMATIC
GENERAL PURPOSE
16 CH DRIVER MODULE
613
0103-00-1135
A

INSTRUCTION MANUAL
MODEL 614
HIGH POWER MODULE

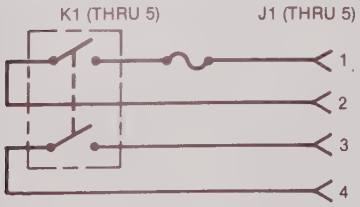
Model 614 is a module that switches high voltages and currents. It can be used to switch line voltages and power supplies. One side of the double pole relays is fused. The fuse holders are conveniently located on the outside of the module. Also, insulating covers (not shown in picture) shield top and bottom of module to protect user from external high voltage.



SPECIFICATIONS

Contact Rating
5A @ 30 Vdc,
3A @ 125 Vac,
2A @ 250 Vac.
Contact Resistance ≤0.07Ω per contact.
Switching Time ≤20 ms.
I/O Connections 20 screw terminals.
Standard Fuse 5A, fast blow.
Power Consumption
1.8 W max @ 12V;
0.36 W per switch.

SWITCH DIAGRAM



TYPICAL OF 5 CHANNELS

Specifications subject to change

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INSTALLATION AND USE

The Model 614 switch module can be installed into any available module slot within the 601 chassis or 602 expansion chassis. To install the module, refer to the installation figure and the following procedure.

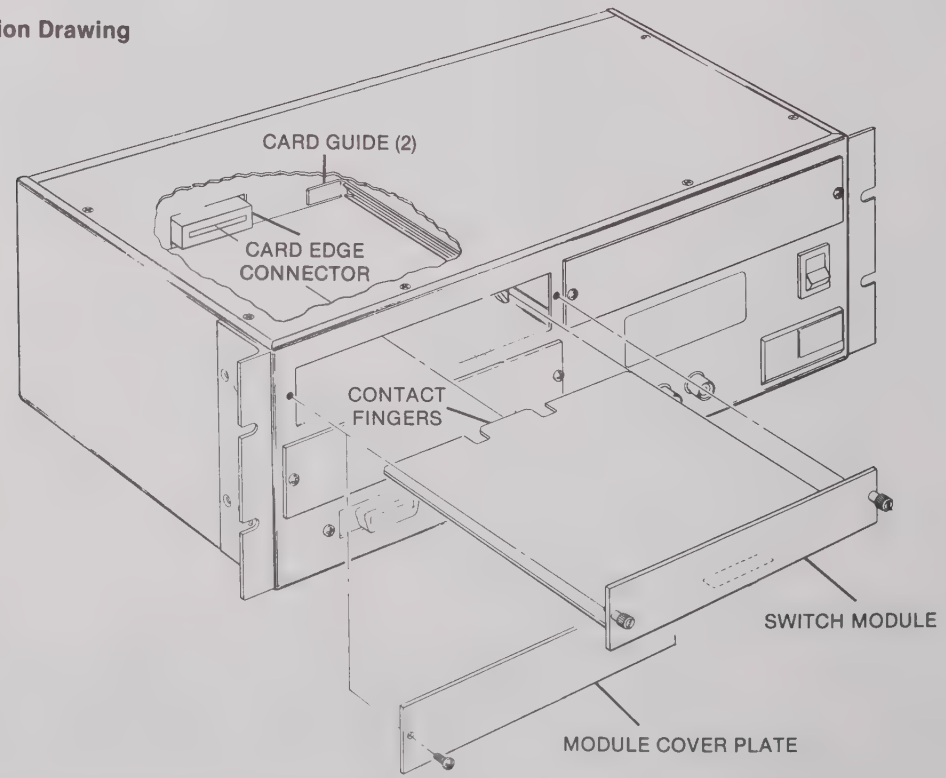
1. Turn the 601 power off.
2. Remove the two screws and the module cover plate.
3. Insert the switch module into the card guides (both sides) and push the module into the chassis. The contact fingers on the switch module printed circuit board must engage the card edge connector in the chassis.
4. Fasten the two captive screws on the switch module.

Once installed, the 614 module provides a 9-bit code that identifies the model number of the module and the number of relays in the module. This code along with the module's slot number is stored in the 601's memory during the power-up routine.

For specific programming information, refer to Section 3 of the Model 600 manual. See the switch diagram on page 1 for switch configuration and signal connections; notice that one side of each relay is fused. The fuses (5A fast blow) are accessible from the module faceplate. Signal connections are made using the internal screw terminals; use the following procedure to install the wires to the screw terminals.

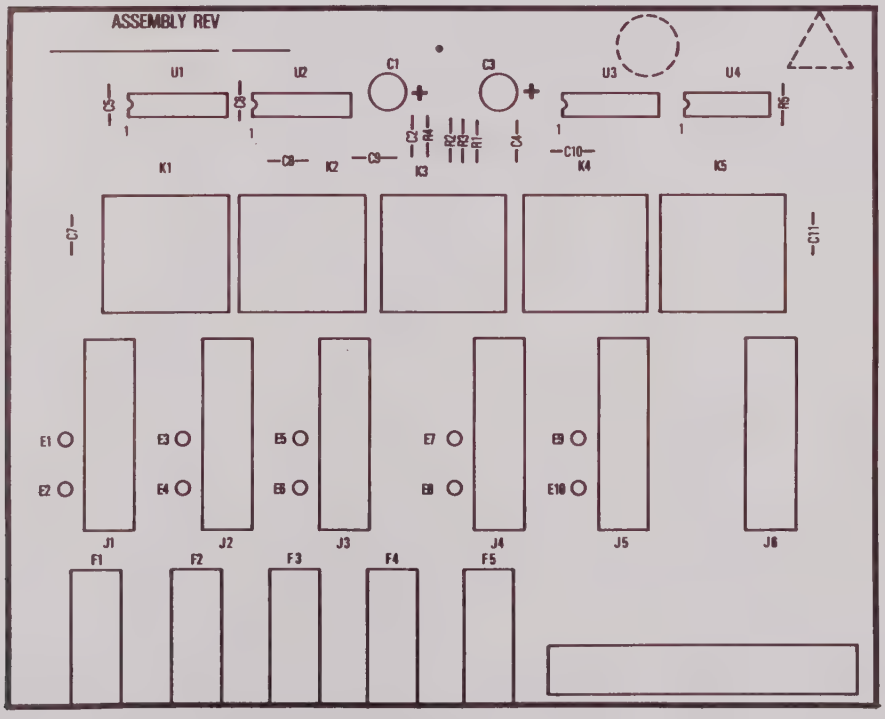
1. Remove the module from the chassis; power must be off.
2. Remove the top plastic cover (2 screws).
3. Remove the metal-foam cable clamp (2 screws).
4. Strip the end of the signal wires to approximately 6.3mm (¼ in.).
5. Route the wire through the opening in the module faceplate.
6. Connect the wires to the desired screw terminal. Then, tighten the screw.
7. Replace the metal-foam cable clamp (2 screws) after all wires are installed and secure.
8. Install the top plastic cover (2 screws).
9. Install the module in the chassis.

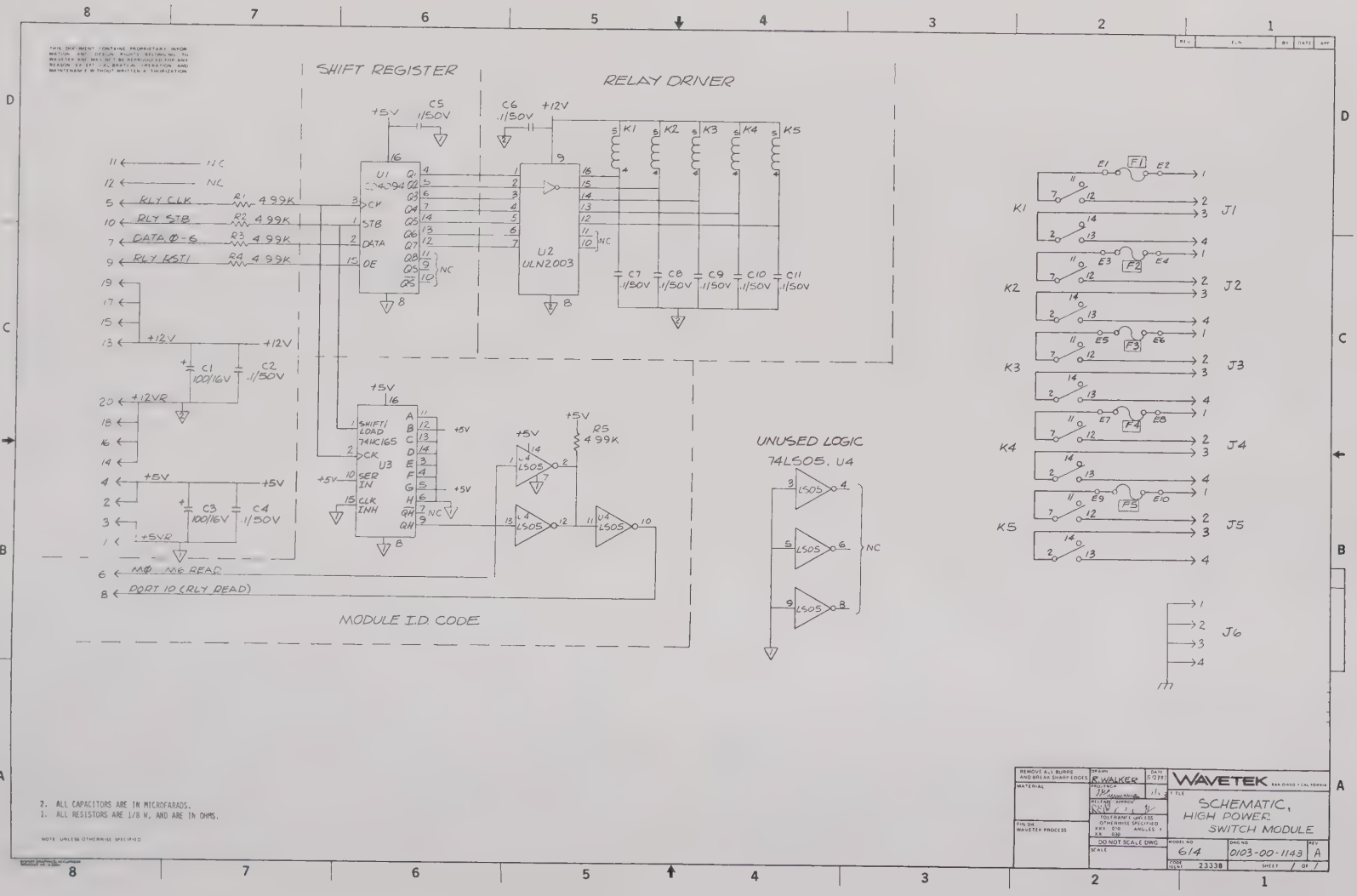
Installation Drawing



REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
1	FACE PLATE, MODULE; REF: 3200-06-0035	1400-01-6690	WVTK	1400-01-6690	1
6	SHIELD, BOTTOM COVER	1400-01-6700	WVTK	1400-01-6700	1
7	SHIELD, TOP COVER	1400-01-6710	WVTK	1400-01-6710	1
3	CLAMP, BAR, LOWER	1400-01-6883	WVTK	1400-01-6883	1
4	CLAMP, BAR, UPPER	1400-01-6893	WVTK	1400-01-6893	1
5	HOLDER, WIRE, FOAM	1400-01-7000	WVTK	1400-01-7000	2
C10 C11 C2 C4 C5 C6 C7 C8 C9	CAP, CER, MON, .1MF, 50V	CAC03Z5U104Z050A	CORNG	1500-01-0405	9
C1 C3	CAP, ELECT, 100MF, 25V RADIAL LEAD, SP .20	CRE SERIES 100/25	CAPAR	1500-31-0102	2
10	HIGH POWER SWITCH MODULE BOARD	1700-00-1148	WVTK	1700-00-1148	1
J1 J2 J3 J4 J5 J6	TERMINAL STRIP 4 PIN PC MOUNT	25.137.0453	ELECT	2100-09-0016	6
8	FUSE HOLD	031.1653/031.1666	SCHUR	2400-05-0012	5
F1 F2 F3 F4 F5	FUSE, 5A, FAST	MTH-5	BUSS	2400-05-0036	5
K1 K2 K3 K4 K5	RELAY, HIGH POWER 250V, 5A	NC2D-JP-12V	AROMT	4500-00-0022	5
R1 R2 R3 R4 R5	RES, MF, 1/8W, 1%, 4.99K	RN55D-4991F	TRW	4701-03-4991	5
U2	IC	ULN2003A	SPRAG	7000-20-0300	1
U1	IC	CD4094BE	RCA	8000-40-9400	1
U4	IC	74LS05	TI	8000-74-0510	1
U3	IC, SHIFT REGISTER	74HC165	MOT	8007-41-6540	1

WAVETEK PARTS LIST	TITLE PCA, HIGH POWER SWITCH MODULE	ASSEMBLY NO. 1100-00-1148 PAGE: 3	REV A

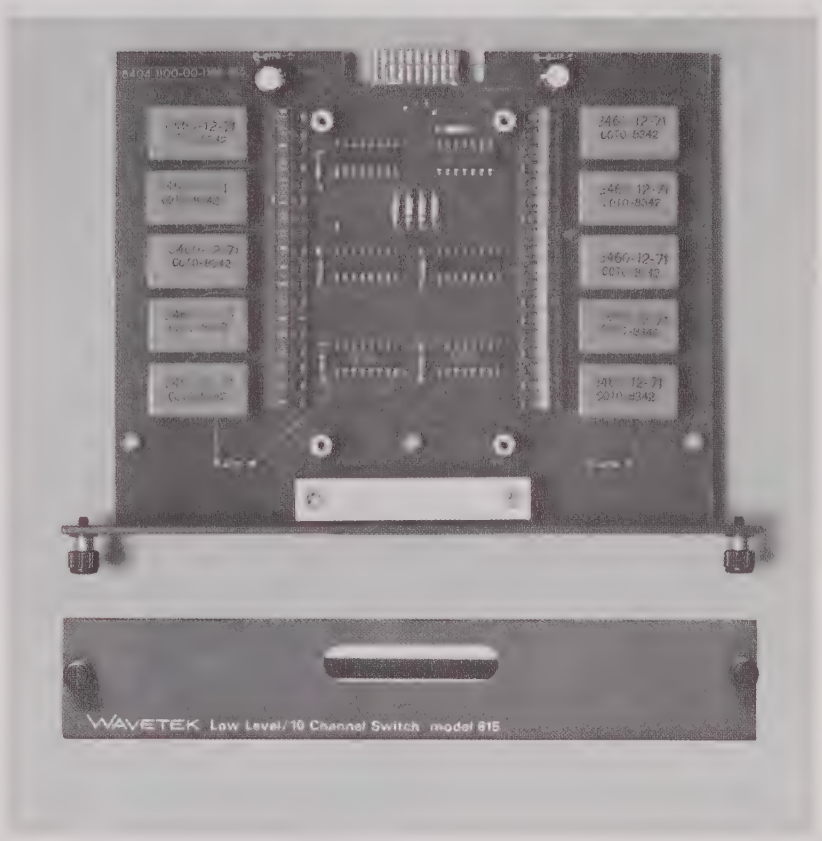




7. ALL CAPACITORS ARE IN MICROFARADS.
1. ALL RESISTORS ARE 1/8 W, AND ARE IN OHMS.

INSTRUCTION MANUAL
MODEL 615
LOW LEVEL 10 CHANNEL MODULE

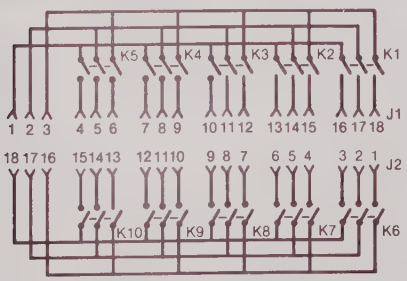
Model 615, a low level, 10 channel module, switches very low level dc signals with relays that contribute no significant amount of thermal emf. There are two sets of five relays. Each relay is three-pole, single-throw for switching high, low and guard.



SPECIFICATIONS

Signal Level 100V, 200 mA, 5W.
Contact Resistance $<0.2\Omega$ per contact.
Insulation Resistance $>10^{12}\Omega$, <5pF.
Contact Potential $<1\mu$V after 20 min warm-up (output to copper leads).
Switching Time ≤ 2 ms.
I/O Connections 36 screw terminals.
Power Consumption
0.8 W max @ 12V;
0.08 W per switch.

SWITCH DIAGRAM



Specifications subject to change

WAVETEK®
WAVETEK SAN DIEGO, INC.
9045 Balboa Ave., San Diego, CA 92123
P. O. Box 85265, San Diego, CA 92138
Tel 619/279-2200 TWX 910/335-2007
P11/83 S11/83

INSTALLATION AND USE

The Model 615 switch module can be installed into any available module slot within the 601 chassis or 602 expansion chassis. to install the module, refer to the installation drawing and the following procedure.

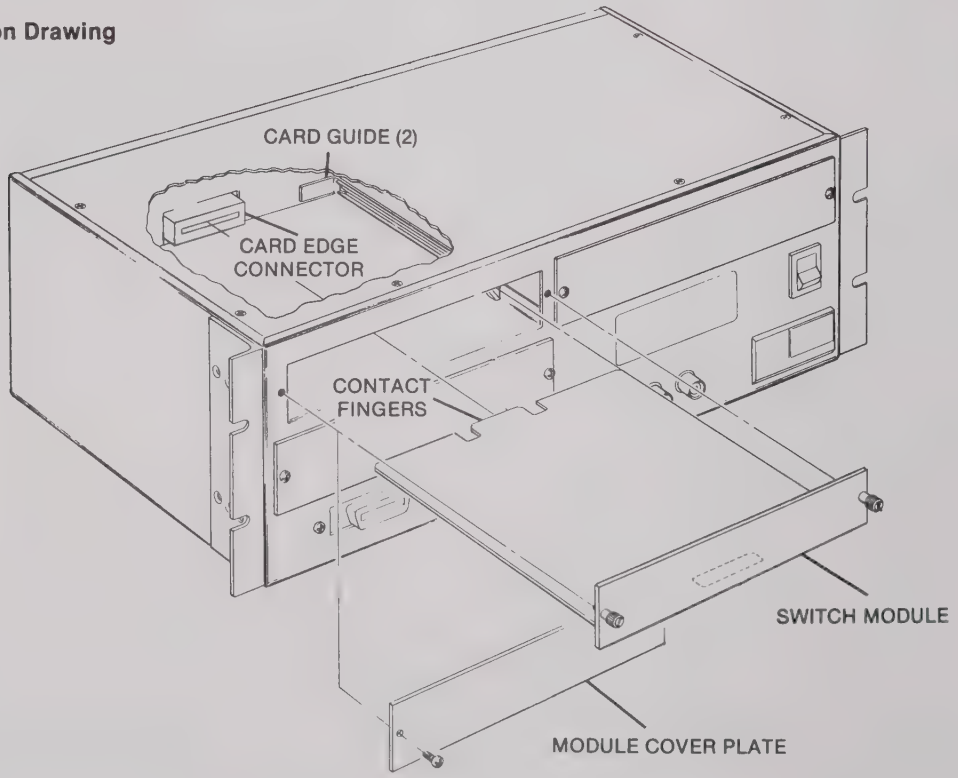
1. Turn the 601 power off.
2. Remove the two screws and the module cover plate.
3. Insert the switch module into the card guides (both sides) and push the module into the chassis. The contact fingers on the switch module printed circuit board must engage the card edge connector in the chassis.
4. Fasten the two captive screws on the switch module.

Once installed, the module supplies a 9-bit code that identifies the number of the module and the number of switches on the module. This code along with the module's slot number is stored in the 601's memory during the power-up routine.

For specific programming information refer to Section 3 Operation of the Model 600 manual. See the switch diagram on page 1 for switch configuration and signal connections. For signal connections, refer to the following procedure.

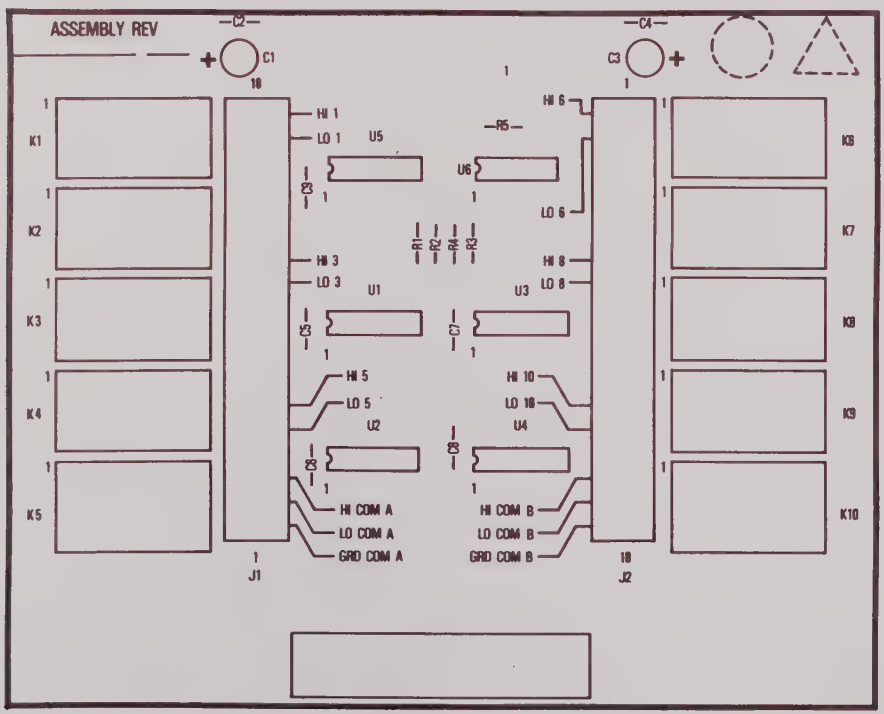
1. Remove the module from the chassis, power must be off.
2. Remove the top plastic cover (3 screws).
3. Remove the metal-foam cable clamp (2 screws).
4. Strip the end of the signal wires to approximately 6.3mm (¼ in.).
5. Route the wire through the opening in the module faceplate.
6. Connect the wires to the desired screw terminal. Then, tighten the screw. Terminal numbers in figure 1 correspond to numbers on the circuit board and screw terminal blocks.
7. When all wires are installed and secure, replace the metal-foam cable clamp (2 screws).
8. Install the top plastic cover (3 screws).
9. Install the module in the chassis.

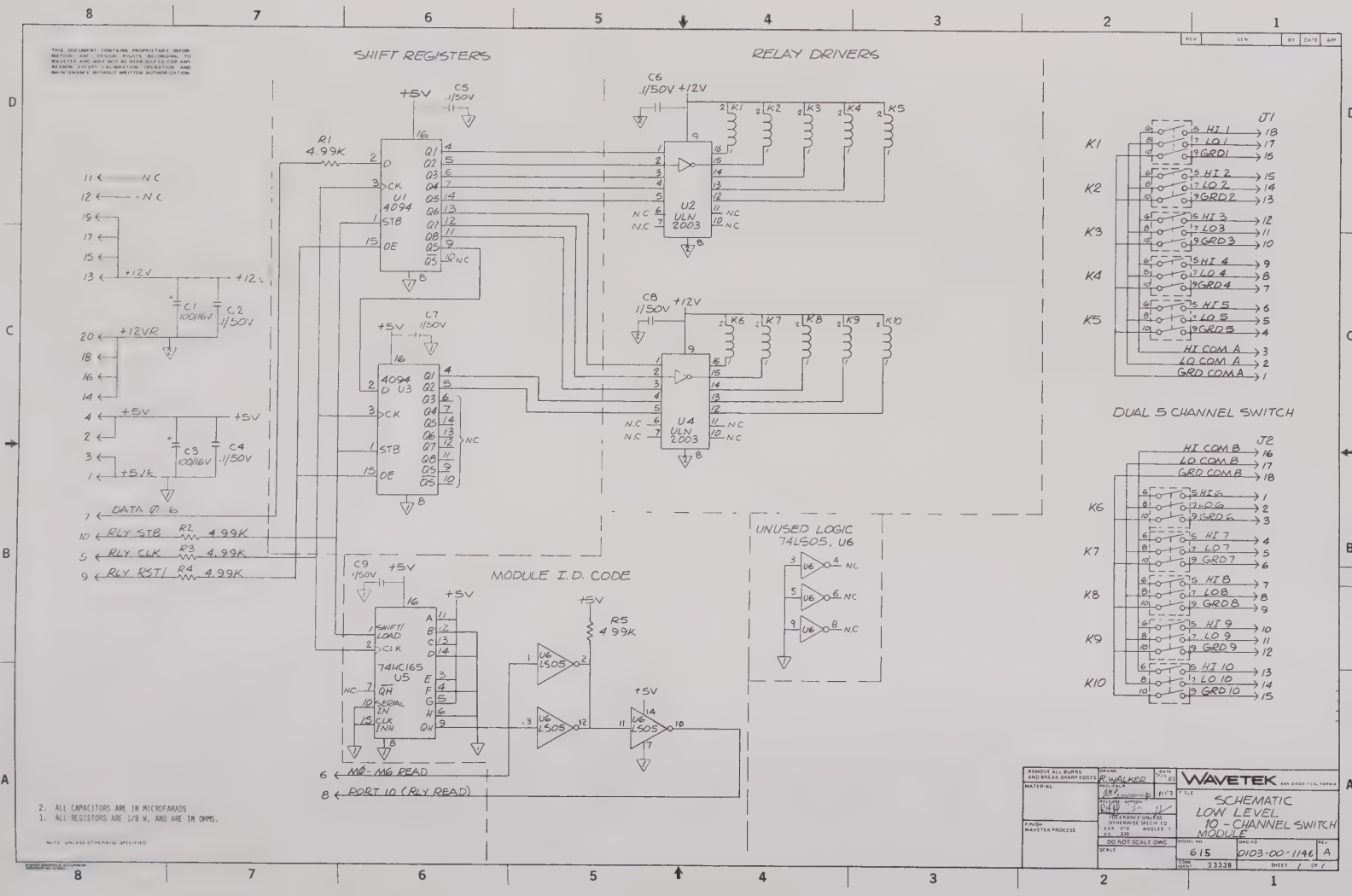
Installation Drawing



REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG, LO LEVEL 10 CHANNEL SWITCH MODULE	0101-00-1218	WVTK	0101-00-1218	1
NONE	SCHEMATIC, LOW LEVEL/10 CH SWITCH MODULE	0103-00-1146	WVTK	0103-00-1146	1
3	CLAMP, BAR, LOWER	1400-01-6883	WVTK	1400-01-6883	1
4	CLAMP, BAR, UPPER	1400-01-6893	WVTK	1400-01-6893	1
5	HOLDER, WIRE, FOAM	1400-01-7000	WVTK	1400-01-7000	2
6	COVER, SHIELD, MODULE	1400-01-7050	WVTK	1400-01-7050	1
1	FACE PLATE REF 3200-06-0035	1400-01-7580	WVTK	1400-01-7580	1
C2 C4 C5 C6 C7 C8 C9	CAP, CER, MON, .1MF, 50V	CAC03Z5U104Z050A	CORNG	1500-01-0405	7
C1 C3	CAP, ELECT, 100MF/16V RADIAL LEAD, SP .20	CRE SERIES 100/16	CAPAR	1500-31-0111	2
8	LOW LEVEL/10 CH SWITCH MODULE BOARD	1700-00-1146	WVTK	1700-00-1146	1
J1 J2	TERMINAL STRIP 18 PIN PC MOUNT	25.135.1853	ELECT	2100-09-0018	2
K1 K10 K2 K3 K4 K5 K6 K7 K8 K9	RELAY, REED	CR-3460-12-71	COTO	4500-00-0019	10
R1 R2 R3 R4 R5	RES, MF, 1/8W, 1%, 4.99K	RN55D-4991F	TRW	4701-03-4991	5
U2 U4	IC	ULN2003A	SPRAG	7000-20-0300	2
U1 U3	IC	CD4094BE	RCA	8000-40-9400	2
U6	IC	74LS05	TI	8000-74-0510	1
U5	IC, SHIFT REGISTER	74HC165	MOT	8007-41-6540	1

WAVETEK PARTS LIST	TITLE PCA, LOW LEVEL/10 CH SWITCH MODULE	ASSEMBLY NO. 1100-00-1218	REV

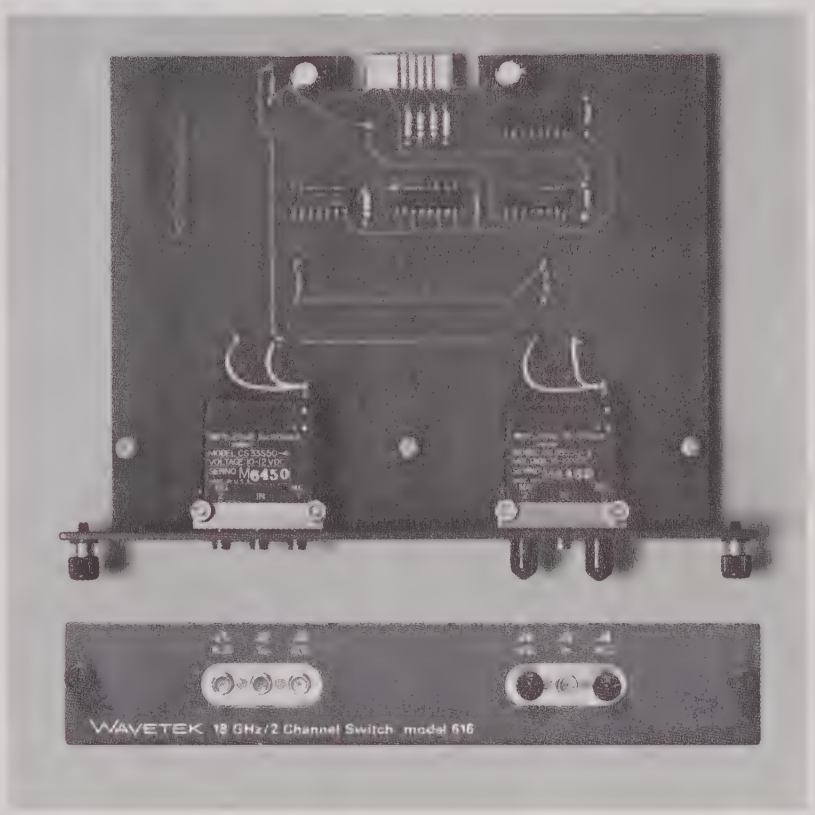



SHIFT REGISTERS
RELAY DRIVERS
MODULE I.D. CODE
UNUSED LOGIC 74LS05, U6
DUAL 5 CHANNEL SWITCH
U1 4094
U2 ULN 2003
U3 4094
U4 ULN 2003
U5 74HC165
U6 LS05
J1
J2
R1 4.99K
R2 4.99K
R3 4.99K
R4 4.99K
R5 4.99K
C1 100/16V
C2 .1/50V
C3 100/16V
C4 .1/50V
C5 .1/50V
C6 .1/50V +12V
C7 .1/50V
C8 .1/50V +12V
C9 .1/50V
+5V
+12V
+12VR
DATA Ø - 6
RLY STB
RLY CLK
RLY RST/
MØ - M6 READ
PORT 10 (RLY READ)
HI 1
LO 1
GRD1
HI 2
LO 2
GRD2
HI 3
LO 3
GRD3
HI 4
LO 4
GRD4
HI 5
LO 5
GRD5
HI COM A
LO COM A
GRD COM A
HI COM B
LO COM B
GRD COM B
HI 6
LO 6
GRD6
HI 7
LO 7
GRD7
HI 8
LO 8
GRD8
HI 9
LO 9
GRD9
HI 10
LO 10
GRD10
2. ALL CAPACITORS ARE IN MICROFARADS.
1. ALL RESISTORS ARE 1/8 W, AND ARE IN OHMS.
WAVETEK
SCHEMATIC
LOW LEVEL
10 - CHANNEL SWITCH
MODULE
615
0103-00-1146
A
23338

INSTRUCTION MANUAL

MODEL 616 DC to 18 GHz MICROWAVE SWITCH MODULE

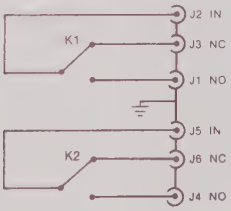
Model 616, a dc to 18 GHz microwave switch module, provides the ultimate in RF switching quality. This module provides two channels of SPDT switching with 18 GHz bandwidth.



SPECIFICATIONS

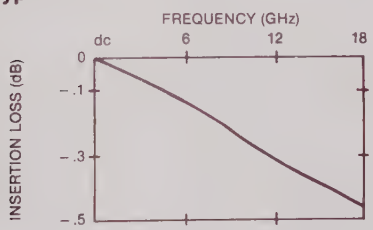
Insertion Loss ≤0.5 dB at 18 GHz.
Isolation ≥60 dB at 18 GHz.
VSWR ≤1.50:1 at 18 GHz.
Switching Time ≤30 ms.
Switch Power 100W at 100 MHz decreasing to 7.5W at 18 GHz.
Switch Rating 70V, 1.4A no switching.
I/O Connections 6 SMA female connectors.
Power Consumption
4.5 W max @ 12V;
2.25 W per switch.

SWITCH DIAGRAM

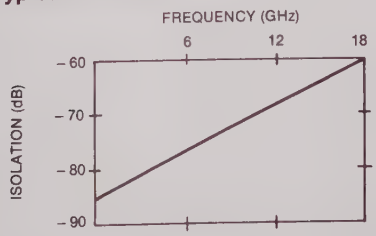


SUPPLEMENTAL INFORMATION

Typical Insertion Loss



Typical Isolation



Specifications subject to change

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WAVETEK SAN DIEGO, INC.
9045 Balboa Ave., San Diego, CA 92123
P. O. Box 85265, San Diego, CA 92138
Tel 619/279-2200 TWX 910/335-2007
P11/83 S11/83

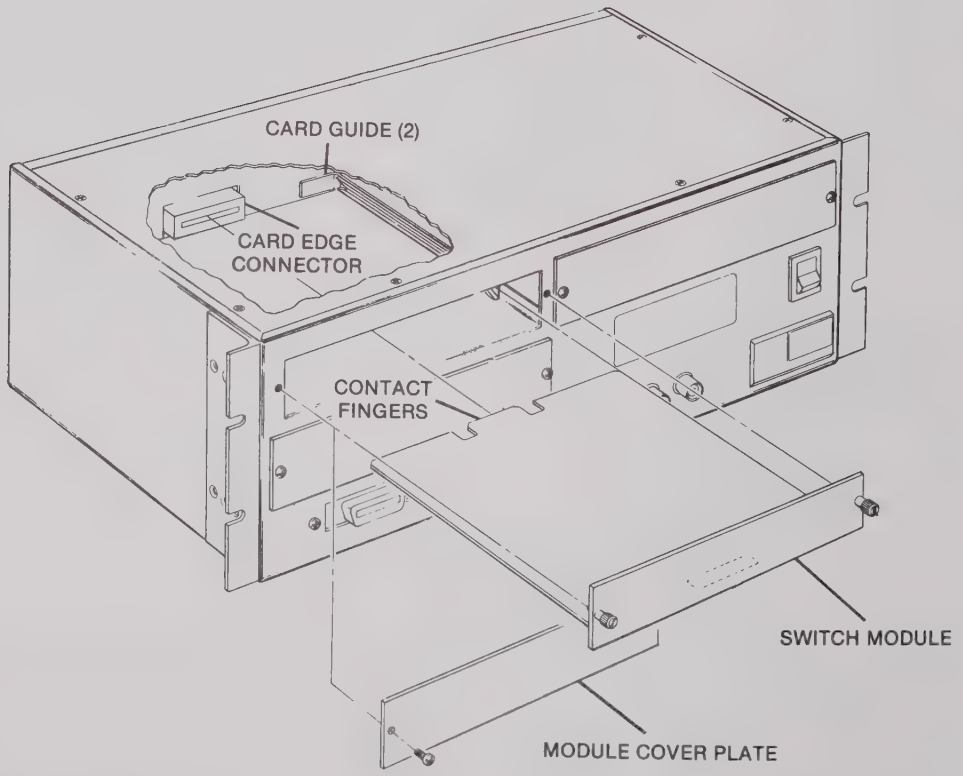
INSTALLATION AND USE

The Model 616 switch module can be installed into any available module slot within the 601 chassis or 602 expansion chassis. To install the module, refer to the installation drawing and the following procedure.

1. Turn the 601 power off.
2. Remove the two screws and the module cover plate.
3. Insert the switch module into the card guides (both sides) and push the module into the chassis. The contact fingers on the switch module printed circuit board must engage the card edge connector in the chassis.
4. Fasten the two captive screws on the switch module.

Once installed, the 616 module provides a 9-bit code that identifies the model number of the module and the number of relays in the module. This code along with the module's slot number is stored in the 601's memory during the power-up routine.

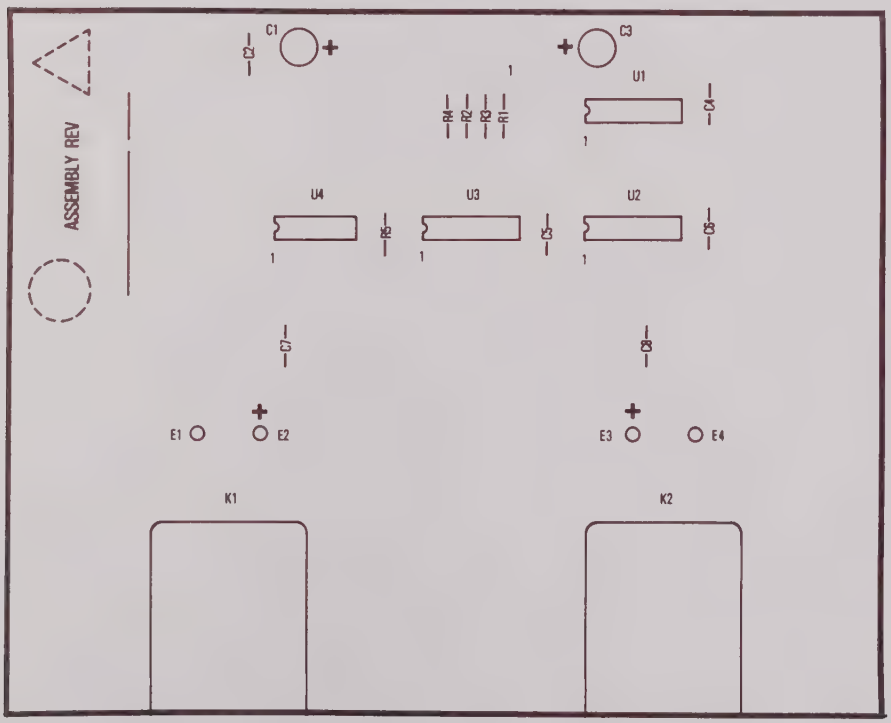
For specific programming information, refer to Section 3 of the Model 600 manual. See the switch diagram on page 1 for relay configuration and signal connections. Signal connections are made using the six SMA female connectors located on the module faceplate.

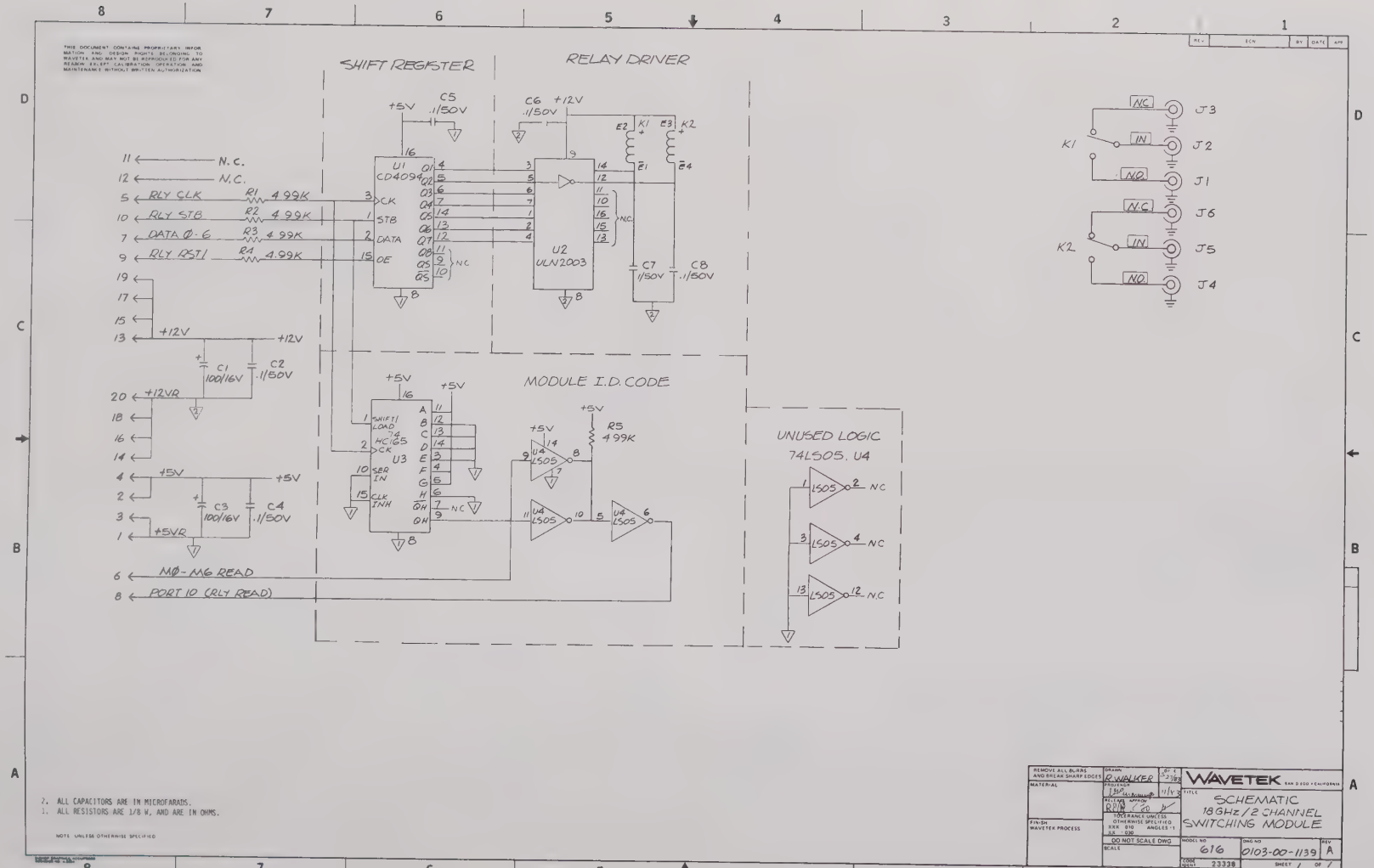


Installation Drawing

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
1	FACE PLATE, MODULE REF 3200-06-0035	1400-01-6680	WVTK	1400-01-6680	1
C2 C4 C5 C6 C7 C8	CAP, CER, MON, .1MF, 50V	CAC03Z5U104Z050A	CORNG	1500-01-0405	6
C1 C3	CAP, ELECT, 100MF, 25V RADIAL LEAD, SP .20	CRE SERIES 100/25	CAPAR	1500-31-0102	2
3	18 GHZ/2 CHANNEL SWITCH MODULE BOARD	1700-00-1139	WVTK	1700-00-1139	1
2	SCREW, CAPTIVE, FLOATING	F7500-P-6-B-1	DUTCH	2800-03-0019	2
7	NUT, HEX, 4-40	MS35649-244	COML	2800-14-4100	4
8	6-32 X 1/4 PAN MACH SCR PLPS PLATED NYLOK PELLET	6-32 X 1/4	CMRCL	2800-23-6104	3
5	WASHER, FLAT, 4(.312 O.D.)	#4FW	WVTK	2800-26-4000	4
4	SCREW, PAN HD, CROSS RECESS, 4-40X7/8LG	MS51957-20	COML	2800-38-4114	4
6	WASHER, SPLIT LOCK,	#4SRLW	WVTK	2800-42-4000	4
K1 K2	RELAY, MICROWAVE 18 GHZ	CS-33B50-4	TLDYN	4500-00-0023	2
R1 R2 R3 R4 R5	RES, MF, 1/8W, 1%, 4.99K	RN55D-4991F	TRW	4701-03-4991	5
U2	IC	ULN2003A	SPRAG	7000-20-0300	1
U1	IC	CD4094BE	RCA	8000-40-9400	1
U4	IC	74LS05	TI	8000-74-0510	1
U3	IC, SHIFT REGISTER	74HC165	MOT	8007-41-6540	1

WAVETEK PARTS LIST	TITLE PCA, 18GHZ/2 CH SWITCH MODULE	ASSEMBLY NO. 1100-00-1139	REV B





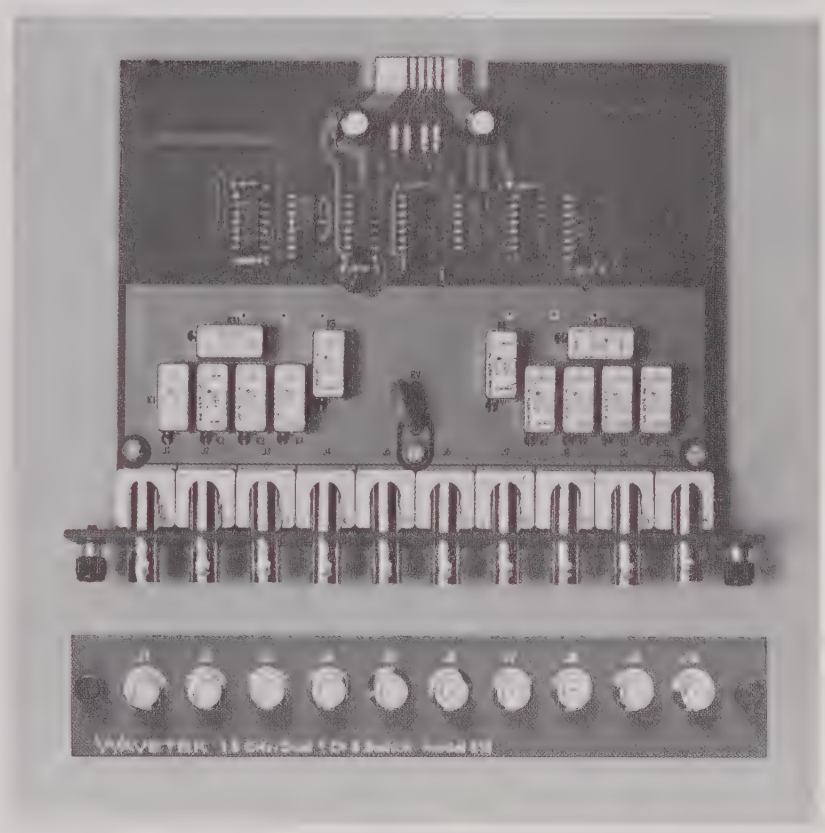
2. ALL CAPACITORS ARE IN MICROFARADS.
1. ALL RESISTORS ARE 1/8 W, AND ARE IN OHMS.

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN R. WALKER	WAVETEK SAN DIEGO, CALIFORNIA	
MATERIAL	ENGINEER	TITLE SCHEMATIC 18GHz/2 CHANNEL SWITCHING MODULE	
FINISH WAVETEK PROCESS	RELEASE APPROVAL		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±10 XX ±.030 ANGLES ±1		
	DO NOT SCALE DWG	MODEL NO 616	DWG NO 0103-00-1139 REV A
	SCALE	CODE IDENT 23338	SHEET 1 OF 1

INSTRUCTION MANUAL
MODEL 618
1.5 GHz, DUAL 1 of 4 MODULE

Model 618, a 1.5 GHz module, offers outstanding RF performance at a very attractive cost per channel. The module has two sets of 1 of 4 channels. Switch actuation mode is always break before make.



SPECIFICATIONS

Insertion Loss 0.5 dB @ 100 MHz.
Bandwidth ≥1.5 GHz @ −3 dB.
Rise Time ≤0.5 ns.
Cross Talk Any channel to any channel; all switches open:

10 MHz	100 MHz	1.5 GHz
≤ −100 dB	≤ −95 dB	≤ −40 dB

Isolation One signal path, input to output; one switch open:

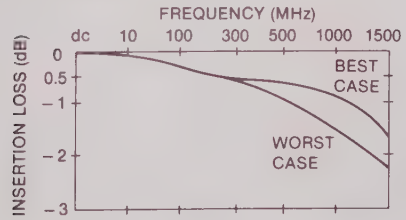
10 MHz	100 MHz	1.5 GHz
≤ −100 dB	≤ −90 dB	≤ −40 dB

VSWR (Typical) ≤1.1:1 @ 200 MHz, ≤1.25:1 @ 500 MHz.
Maximum V/A/W 100V, 2A, 60W.
Contact Resistance ≤0.25Ω/switch.
Switching Time ≤10 ms.
I/O Connections 10 BNC, female.
Power Consumption
3.3 W max @ 12V; 0.3 W per switch.

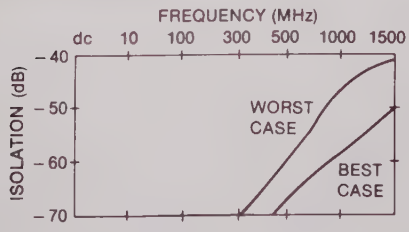
Specifications subject to change

SUPPLEMENTAL INFORMATION

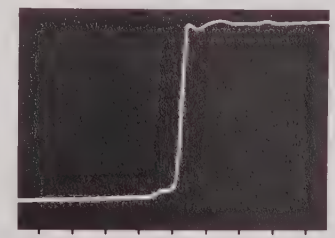
Typical Insertion Loss



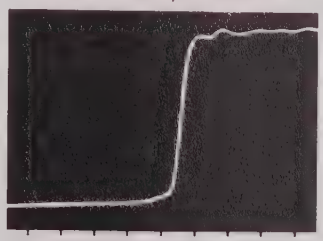
Typical Isolation



Typical Sub-nanosecond Pulse Response

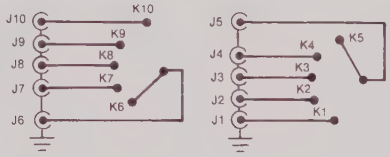


INPUT WAVEFORM, T_r = 200ps (500ps/DIV)



OUTPUT WAVEFORM (500ps/DIV)

SWITCH DIAGRAM



WAVETEK®
WAVETEK SAN DIEGO, INC.
9045 Balboa Ave., San Diego, CA 92123
P. O. Box 85265, San Diego, CA 92138
Tel 619/279-2200 TWX 910/335-2007

P11/83 S11/83

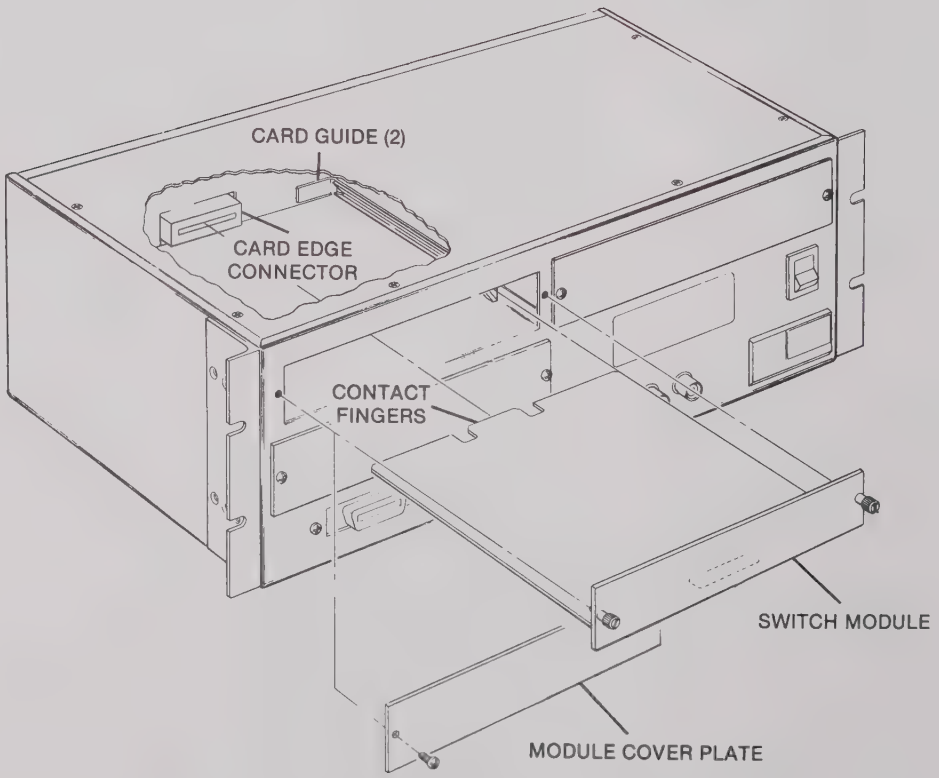
INSTALLATION AND USE

The Model 618 switch module can be installed into any available module slot within the 601 chassis or 602 expansion chassis. To install the module, refer to the installation figure and the following procedure.

1. Turn the 601 power off.
2. Remove the two screws and the module cover plate.
3. Insert the switch module into the card guides (both sides) and push the module into the chassis. The contact fingers on the switch module printed circuit board must engage the card edge connector in the chassis.
4. Fasten the two captive screws on the switch module.

Once installed, the 618 module provides a 9-bit code that identifies the model number of the module and the number of relays in the module. This code along with the module's slot number is stored in the 601's memory during the power-up routine.

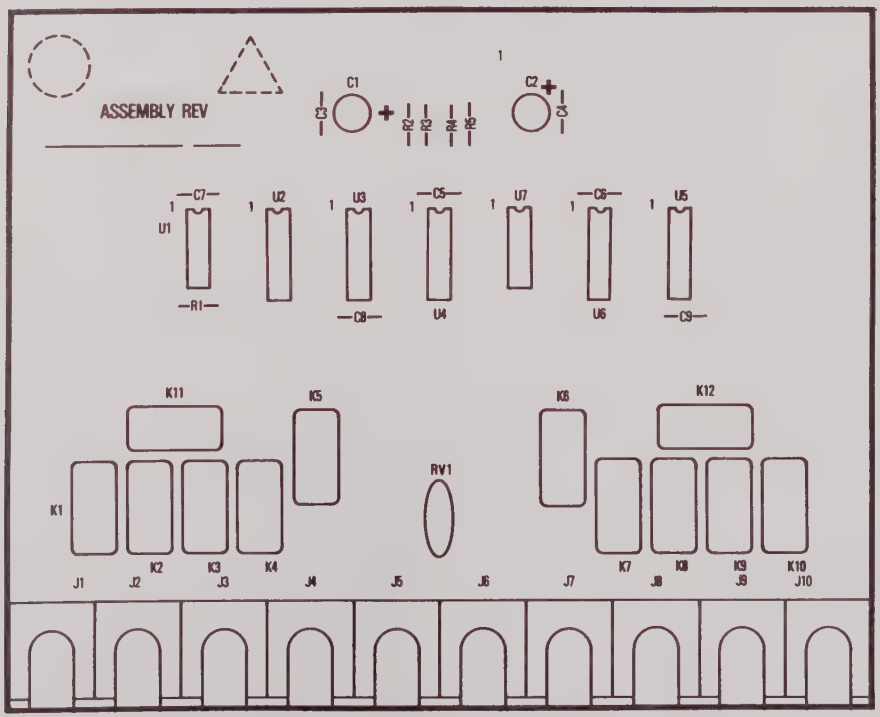
For specific programming information, refer to Section 3 of the Model 600 manual. See the switch diagram on page 1 for relay configuration and signal connections. Signal connections are made using the ten BNC connectors located on the module faceplate.

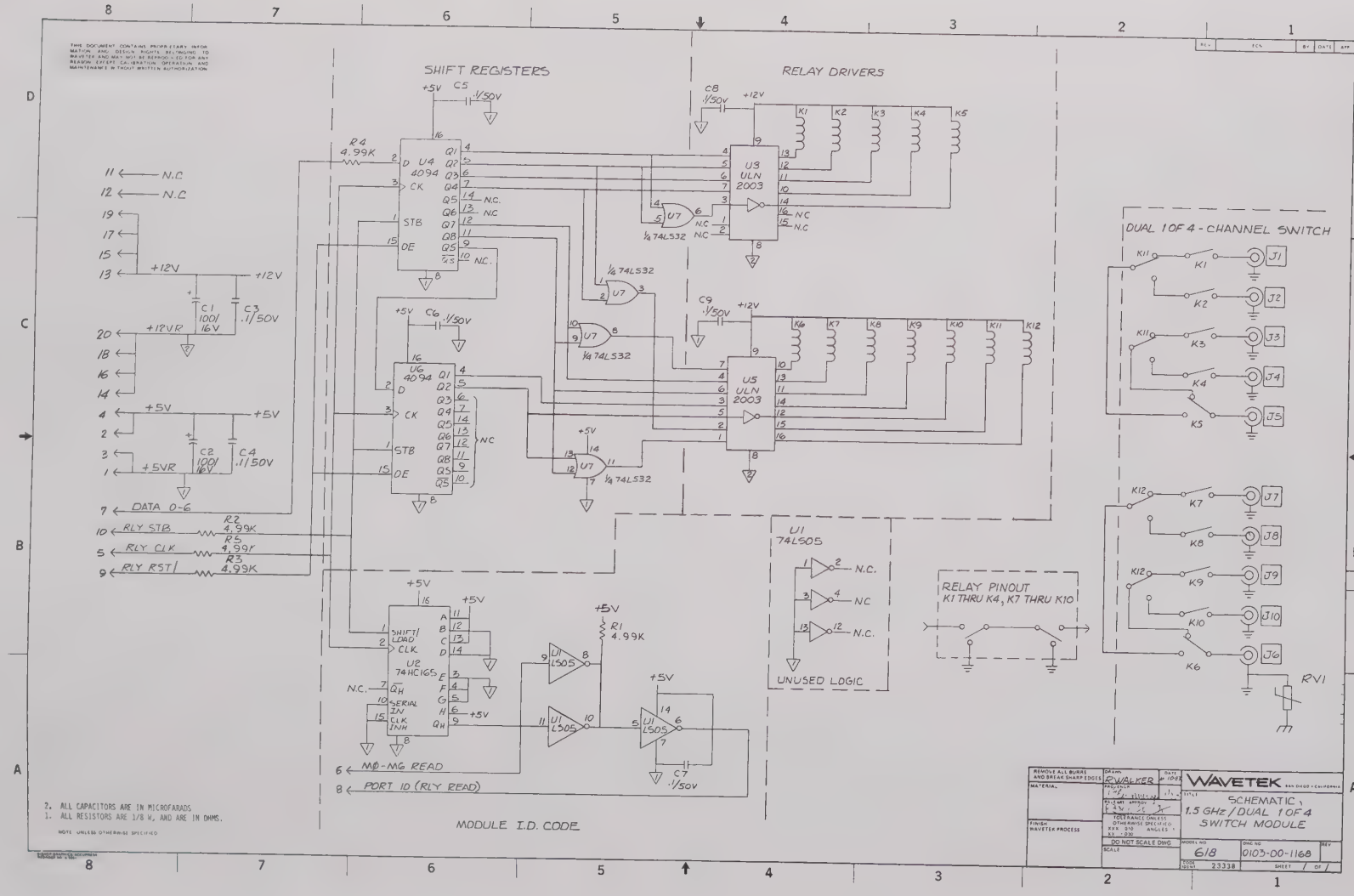


Installation Drawing

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
1	FACE PLATE, MODULE FROM: 1400-01-6822	1400-01-7069	WVTK	1400-01-7069	1
C3 C4 C5 C6 C7 C8 C9	CAP, CER, MON, .1MF, 50V	CAC03Z5U104Z050A	CORNG	1500-01-0405	7
C1 C2	CAP, ELECT, 100MF, 25V RADIAL LEAD, SP .20	CRE SERIES 100/25	CAPAR	1500-31-0102	2
3	1.5GHZ/DUAL 1 OF 4 SWITCH MODULE	1700-00-1168	WVTK	1700-00-1168	1
J1 J10 J2 J3 J4 J5 J6 J7 J8 J9	CONN, BNC, PC MOUNT RIGHT ANGLE	KC-79-237M06	KINGS	2100-01-0020	10
2	SCREW, CAPTIVE, FLOATING	F7500-P-6-B-1	DUTCH	2800-03-0019	2
4	6-32 X 1/4 PAN MACH SCR PLPS PLATED NYLOK PELLET	6-32 X 1/4	CMRCL	2800-23-6104	3
K1 K10 K11 K12 K2 K3 K4 K5 K6 K7 K8 K9	RELAY, 12V COIL, METAL CAN	HFW12103J301	CII	4500-00-0025	12
R1 R2 R3 R4 R5	RES, MF, 1/8W, 1%, 4.99K	RN55D-4991F	TRW	4701-03-4991	5
RV1	VARISTOR	V56ZA8	GE	4799-00-0048	1
U3 U5	IC	ULN2003A	SPRAG	7000-20-0300	2
U4 U6	IC	CD4094BE	RCA	8000-40-9400	2
U1	IC	74LS05	TI	8000-74-0510	1
U7	IC	74LS32	TI	8000-74-3210	1
U2	IC, SHIFT REGISTER	74HC165	MOT	8007-41-6540	1

WAVETEK PARTS LIST	TITLE PCA, 1.5GHZ/DUAL 1 OF 4 SWITCH MODULE	ASSEMBLY NO. 1100-00-1168	REV B




SHIFT REGISTERS
RELAY DRIVERS
DUAL 1 OF 4 - CHANNEL SWITCH
U1 74LS05
UNUSED LOGIC
RELAY PINOUT K1 THRU K4, K7 THRU K10
MODULE I.D. CODE
DATA 0-6
RLY STB
RLY CLK
RLY RST
MD-MG READ
PORT ID (RLY READ)
+5V
+12V
+12VR
+5VR
N.C.
RV1
SCHEMATIC, 1.5 GHz/DUAL 1 OF 4 SWITCH MODULE
WAVETEK
618
0103-00-1168
23338
2. ALL CAPACITORS ARE IN MICROFARADS.
1. ALL RESISTORS ARE 1/8 W, AND ARE IN OHMS.

APPENDIX B
AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE (ASCII)

b7 b6 b5 / BITS					0_0	MSG[1]	0_1	MSG	0_1	MSG	1_0	MSG	1_1	MSG	1_0	MSG	1_1	MSG
b4	b3	b2	b1	column / row	0		1		2		3		4		5		6		7	
0	0	0	0	0	NUL		DLE		SP	↑	0	↑	@	↑	P	↑	\	↑	p	↑
0	0	0	1	1	SOH	GTL	DC1	LLO	!		1		A		Q		a		q	
0	0	1	0	2	STX		DC2		"		2		B		R		b		r	
0	0	1	1	3	ETX		DC3		#		3		C		S		c		s	
0	1	0	0	4	EOT	SDC	DC4	DCL	$		4		D		T		d		t	
0	1	0	1	5	ENQ	PPC[3]	NAK	PPU	%		5		E		U		e		u	
0	1	1	0	6	ACK		SYN		&		6		F		V		f		v	
0	1	1	1	7	BEL		ETB		'		7		G		W		g		w	
1	0	0	0	8	BS	GET	CAN	SPE	(		8		H		X		h		x	
1	0	0	1	9	HT	TCT	EM	SPD	)		9		I		Y		i		y	
1	0	1	0	10	LF		SUB		*		:		J		Z		j		z	
1	0	1	1	11	VT		ESC		+		;		K		[		k		{	
1	1	0	0	12	FF		FS		,		<		L		\		l		|	
1	1	0	1	13	CR		GS		-		=		M		]		m		}	
1	1	1	0	14	SO		RS		.		>		N		^		n		~	
1	1	1	1	15	SI		US		/		?	UNL	O		_	UNT	o		DEL	

MLA ASSIGNED TO DEVICE

MLA ASSIGNED TO DEVICE

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MTA ASSIGNED TO DEVICE

MEANING DEFINED BY PCG CODE

MEANING DEFINED BY PCG CODE

ADDRESSED COMMAND GROUP (ACG)

UNIVERSAL COMMAND GROUP (UCG)

LISTEN ADDRESS GROUP (LAG)

TALK ADDRESS GROUP (TAG)

PRIMARY COMMAND GROUP (PCG)

SECONDARY COMMAND GROUP (SCG)

[1]MSG = INTERFACE MESSAGE
[2]b1 = DIO1 . . . b7 = DIO7
[3]REQUIRES SECONDARY COMMAND
[4]DENSE SUBSET (COLUMN 2 THROUGH 5)

DC4	= DCL	Device clear	Universal Command Group
DC1	= LLO	Local lockout	
NAK	= PPU	Parallel poll unconfigure	
EM	= SPD	Serial poll disable	
CAN	= SPE	Serial poll enable	
SOH	= GTL	Go to local	Addressed Command Group
EOT	= SDC	Selected device clear	
ENQ	= PPC	Parallel poll configure	
BS	= GET	Group execute trigger	
HT	= TCT	Take control	

APPENDIX C
PROGRAMMING COMMAND SUMMARY
(Excluding GPIB Command Groups Given in Appendix B).

Control and Data Names	603 Control Panel Key	ASCII Character
0,1,2,. . .9	0.1,2,. . .9	0,1,2,. . .9
Delay Mode	Mode	B
Close Switch	Closed	C
Switch Delay	Delay	D
Make-before-break	Make First	F
Break-before-make	Break First	G
Immediate	Immediate	H
Execute	Execute	I
Switch Number	Number	K
Delete Setting	Delete	L
Store Setting	Store	M
Open Switch	Open	O
Trigger Input	Trigger Input	Q
Recall Setting	Recall	Y
Reset	Reset	Z
GET Mode	_____	XG
Module Selection	Module	XM
SRQ Mode Selection	_____	XQ
Talk Mode Selection	_____	XT
Decrement Recall	_____	XU
Terminator Type	_____	XV
Increment Recall	_____	XW

Mode (B) Codes

0 No delay
1 Delay on close
2 Delay on open
3 Delay on both open and close

Delay (D) Codes

0 0 ms delay
1 25 ms delay
2 50 ms delay
3 75 ms delay
4 100 ms delay
5 125 ms delay
6 150 ms delay
7 175 ms delay

Trigger Input (Q) Codes

0 Trigger input ignored.
1 Increment to next stored setting on positive slope.
2 Increment to next stored setting on negative slope.

GET Mode (XG) Codes

NOTE: This parameter selects which kind of actions occur when a Group Triger (GET) command is sent to the 601.

0 Upon receipt of GET, the programmed parameter values are transferred to the switch modules. This is the same as an execute (I)

except no error checking is done.

1 Upon receipt of GET, the stored setting next in sequence after the last stored setting accessed is recalled, if it exists, and executed.

–1 Upon receipt of GET, the stored setting previous in sequence before the last stored setting accessed is recalled, if it exists, and executed. This is the same sequence of events that would occur if a Decrement Recall and Execute (WUI) were programmed.

SRQ (XQ) Code

NOTE: This parameter selects the conditions under which the SRQ line is asserted. Value can be 0 through 255. The equivalent binary value masks or unmasks the serial poll response byte bits as shown in table C-1 example: Binary 1 = Selected, Binary 0 = Not Selected.

XQ1 is the SRQ power-up mode. (The rsv bit is always asserted, selected or not.)

Table C-1
Serial Poll Response Byte

Bit Weight	128	64	32	16	8	4	2	1
Bit Meaning	SRQ Key	rsv	Execute Complete	Low Battery	Undefined Bit	Undefined Bit	Undefined Bit	Program Error
Example*	1	0	0	0	0	0	0	1

**A SRQ mode value of 129 (10000001 binary) would only allow a service request to be generated if a Program Error or SRQ key pressed was detected.*

Talk Mode (XT) Code

NOTE: This parameter specifies how the 601 chassis responds when addressed as a talker.

0 Selects the program error list. A typical error list is E 1K 3Y where:

a. All error list begin with E followed by a space.

b. The most recent error appears at the end of the list.

c. Errors are separated by spaces.

d. An error consists of a class number followed by the parameter that caused the error.

Reading the error lists will clear it.

1 Selects the poll byte response. A typical response might be P A where:

a. All responses begin with P followed by a space.

b. The third character has been the same value as the serial poll response byte. This character has a decimal value between 0 and 255. In the typical response above the A represent a decimal value of 65.

Reading the poll byte clears it.

2 Selects the switch status talk response. In this mode all parameters describing a switch configuration will be returned. A typical response might be K9CD3B1 where:

a. K9 is the switch number.

b. C indicates the switch is closed. An 0 represents an open switch.

c. D3 indicates a delay of 3 (75 ms).

d. B1 indicates delay mode 1 (Delay Closed).

3 Selects the module number as the talk response. In this mode the 601 returns the model number of the currently selected switch module. A typical example might be 611.

4 Selects the version identification: 601 (V1.7), where V1.7 represents the software version number.

Terminator Type (XV) Code

NOTE: This parameter designates the End Of String (EOS) or terminator character recognized by the 601.

0 Selects Line Feed (LF of OA_{16}).1

1 Selects Carriage Return (CR or OD_{16}).

2 Selects both Carriage Return and Line Find (LF and CR, or OA_{16} and OD_{16}).

3 Selects no terminator character.

APPENDIX D
SAMPLE PROGRAM

The following program, written in BASIC, gives an example of how a GPIB controller, in this example a Wavetek Model 6000 Instrumentation Controller, checks and reports the status of a Model 600 Switcher System. Any type switch module may be plugged into a slot, but in this example the Models 618, 610, and 615 modules were chosen. Also, the instrument address, in this example, is set to 11. If a different address is used, make the appropriate changes in the "WRITE @" and "READ @" commands. Because BASIC commands may vary, depending upon the controller, changes may need to be made in the program; pay particular attention to the commands that send data to and from the switcher system, such as program lines 140 and 150.

Sample Program

```
100 CLEAR
110 ! MODEL 600 SWITCHER STATUS CHECK PROGRAM
120 DIM A$*35,B$(10)*35,C$*35,D$(3)*35,K$*35
130 WRITE @711:"XM3K1CB0D0 K2OB2D1K3CB1D4XM10XM2K23CI"
140 WRITE @711:"XT0"
150 READ @711:A$
160 WRITE @ 711:"M1I"
170 FOR I=1 TO 7
180 WRITE @711:"XT3 XM";I
190 READ @711:B$(I)
200 IF I>3 THEN 230
210 WRITE @711:"XT2 XM3 K";I
220 READ @711:D$(I)
230 NEXT I
240 WRITE @711:"XT4"
250 READ @711:C$
260 PRINT "SWITCHER STATUS REPORT EXAMPLE"
270 PRINT "============================="
280 PRINT
290 IF A$="E " THEN LET A$="NO ERRORS !"
300 PRINT "THE ERROR REGISTER CONTENTS ARE :";A$
310 PRINT
320 FOR I=1 TO 7
330 IF B$(I)="6XX " THEN
340 PRINT "SLOT NR. ";I;" IS EMPTY!"
350 GO TO 380
360 END IF
370 PRINT "MODULE NR. ";I;" IS MODEL NR. ";B$(I)
380 NEXT I
390 PRINT: PRINT
400 FOR I=1 TO 3
410 PRINT "STATUS OF SWITCH NR. ";I;"IN MODULE NR. 3 IS :
";D$(I)
420 NEXT I
430 PRINT
440 PRINT "FIRMWARE VERSION :";C$
450 WRITE @711:"Y1I"
460 WRITE @711:"XT0"
470 READ @711:K$
480 IF K$="E " THEN LET K$="NO ERRORS."
490 PRINT
500 PRINT "THE ERROR REGISTER CONTENTS ARE: ";K$
510 WRITE @711:"XT0"
520 READ @711:K$
530 PRINT
540 PRINT "THE ERROR REGISTER CONTENTS ARE: ";K$
550 END
```

Sample Program Explanation

100 Clears the controller.
110 A remark statement.
120 Dimensions the variables and arrays.
130 Programs the three switches in module slot 3.
    K1CB0D0 - Switch 1, closed, no delay 0ms delay.
    K2OB2D1 - Switch 2, open, delay on open, 25ms delay.
    K3CB1D4 - Switch 3, closed, delay on close, 100ms.
    XM10 - Selects module 10, a deliberate error.
    XM2K23C - Closes switch 23 on module slot 2, a deliberate error.
    I - Executes this command string.
140 Selects Talk Mode 0 - Program Error List.
150 Reads the error register and stores it as A$.
160 Tells the 601 to store the set up in memory location 1.
170 - 230 A seven step loop that identifies the switch module model numbers and switch status of 3 switches in module number 3.
240 Places the 601 in Talk Mode 4: Software Version.
250 Reads the software version and stores it as C$.
260 Starts the Switcher Status Report Example printout.
290 - 300 Prints the contents of the Program Error List which was read in line 140. Error register is cleared when read. If there are no errors, the printout will read "NO ERRORS".
320 - 380 Prints the module's model number and slot location. Also identifies empty slots. Note: If a slot is empty, Talk Mode 3(XT3) returns 6XX .
400 - 420 Prints the status of the first three switches of the module in slot 3.
440 Prints the firmware version.
450 Tells the 601 to recall the contents of stored setting memory location 1 and execute it.
460 Places the 601 in Talk Mode 0 (XT0) - Program Error Register.
470 Reads the program error register. This should always be done to clear the register before beginning a new program.
500 Print the Program Error List.
550 End of the program.

Sample Program's Printout

```
SWITCHER STATUS REPORT EXAMPLE
==============================
THE ERROR REGISTER CONTENTS ARE:E 1XM 1K

MODULE NR. 1 IS MODEL NR. 618
MODULE NR. 2 IS MODEL NR. 610
MODULE NR. 3 IS MODEL NR. 615
SLOT NR. 4 IS EMPTY!
SLOT NR. 5 IS EMPTY!
SLOT NR. 6 IS EMPTY!
SLOT NR. 7 IS EMPTY!

STATUS OF SWITCH NR. 1 IN MODULE NR. 3 IS: K1CD0B0
STATUS OF SWITCH NR. 2 IN MODULE NR. 3 IS: K2OD1B2
STATUS OF SWITCH NR. 3 IN MODULE NR. 3 IS: K3CD4B1

FIRMWARE VERSION :601 (V1.7)

THE ERROR REGISTER CONTENTS ARE: E 1XM 1XM 1XM

THE ERROR REGISTER CONTENTS ARE: E
```

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